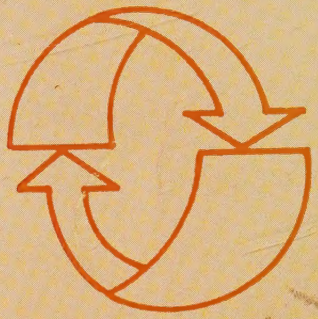
BIOFEEDBACK

METHODS AND PROCEDURES IN CLINICAL PRACTICE



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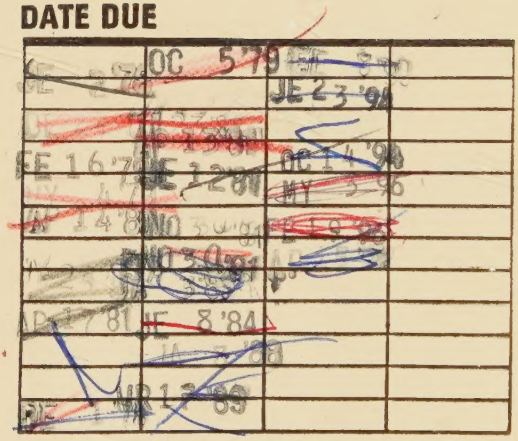

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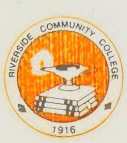

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BIOFEEDBACK:

METHODS AND PROCEDURES IN CLINICAL PRACTICE

BY

GEORGE D. FULLER, Ph.D.

BIOFEEDBACK INSTITUTE OF SAN FRANCISCO

SAN FRANCISCO, CALIFORNIA

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FOREWORD

The world of science is a world of paradox and controversy. There are those who believe firmly that science is a steady, logical accumulation of knowledge which will bring us even closer to the truth. There are others, notably the scientist-historian Thomas S. Kuhn, who depict scientific progress more as a series of increasingly complex, violent intellectual revolutions separated by prolonged periods of dogmatic tranquility. Based on my own experience I am tending more and more to side with Kuhn. We are currently approaching the end of a long period of relative tranquility in the health sciences. The signs of revolution are everywhere: within the health professions there has been a dramatic ascendance of holistic medicine and humanistic psychology; other factions have brought empirical disciplines such as acupuncture and Eastern meditations to the public's attention; finally, we have seen the movement of literally millions of people through neatly packaged, non-professional weekend marathons in search of "better" mental health.

In the minds of many, biofeedback is a part of this revolution. In some ways this is true, but, in fact, biofeedback represents its own separate and clearly less divergent revolution. To the extent that frustrated clinicians and desperate patients have provided the motivational basis for the development of this alternative approach to treatment, biofeedback reflects the current shortcomings of the medical model. Moreover, by its very nature biofeedback must deal with the whole person and invokes the central element of individual responsibility.

Biofeedback, however, has its roots in laboratory science and in technology. Its strongest advocates embrace pathophysiological concepts and employ logical investigation in seeking answers to important questions of mechanism and effective therapeutic application. Its premises are psychophysiological and consistent with some of the most fundamental concepts of biology. More than any of the other revolutionary elements, the field of biofeedback has brought scientist and clinician together in search of constructive advancement.

As with more traditional health fields, while controlled scientific investigation continues to examine and organize this area, clinicians press onward with its therapeutic application. In the right hands this application is cautious, insightful and directed not only toward immediate dividends, but also to the careful collection of relevant information and a systematic contribution to the future of the field.

The Biofeedback Institute of San Francisco, and its director, Dr. George Fuller, has been dedicated to this cautious, contributory approach. Efforts to integrate developments in the field of biofeedback with traditional clinical practice led to the gradual compiling of materials for a manual. This text, while clearly directed to the novice, presents important background information and a concise overview of the fundamental concept and technology of clinical biofeedback. Years of practical experience together with the careful cataloging of methods, applications and potential outcomes are represented.

I congratulate Dr. Fuller for the sound professional guidelines which he presents and for the effort made to provide a well organized, comprehensive and highly ethical introduction to this important new pathway of rebellion.

M. B. Sterman, Ph.D.

Los Angeles, California

July 1977

PREFACE

Long in demand has been a clinical manual which discusses the very real practical problems which face clinicians who integrate biofeedback into their practices. This manual reflects the combined expertise of a multidisciplinary staff of psychiatrists, psychologists, physical therapists and others in the treatment of numerous psychophysiological disorders.

This book is meant to be a manual for the professional who uses or plans to use biofeedback clinically. It suggests procedures and methods that have been effective over the past five years at the Biofeedback Institute of San Francisco. The methods are not necessarily the correct ones, but they have proven most effective in our setting and might generate ideas in your practice of biofeedback. While our work continues, constant reassessment and revision of these procedures will, of necessity, take place. It is a continuing process.

Readers should bear in mind also that this book represents a practical manual rather than a scholarly work. Portions such as Clinical Applications are necessarily condensed. The description and differential diagnosis highlights should not be used as a substitute for a thorough work-up by a qualified physician. These descriptions are intended to capsulize the most relevant features of the disorder in order to aid the clinician in appropriate treatment or referral.

In short, this is a guide not a cookbook. The application of biofeedback requires an awareness of the limitations of one's training and experience, whether it is used to facilitate self-growth in an educational model or for the treatment of a

cardiac arrhythmia in a medical model.

While much has been published in the research literature in biofeedback, there is pitifully little that is available by the clinician or for the clinician. Few clinicians have the predilection or pressure to write since the focus is on treatment rather than publication, as in the "publish or perish" model. Additionally, most research studies are dissimilar to the kinds of issues and problems encountered in the clinical practice of biofeedback. While it is true that the research (such as that published in the Aldine-Atherton Annuals and Biofeedback and Self Regulation Journal) is of high quality and has importance to the application of biofeedback, the articles rarely address themselves to the more immediate problems of clinical practice.

This manual is intended to provide reference, guide and text functions to a variety of different practitioners. It may be used by experienced biofeedback clinicians to compare procedures with their own and to stimulate thinking and provide different perspectives. It is also intended for the beginning biofeedback therapist, student and biofeedback assistant to be used in training programs and to provide a philosophy and framework for development. In addition, others in biofeedback research, medicine, psychology, physiology and related areas may find ideas, summaries, research format and findings, recordkeeping forms and other features of this book useful in their own work.

I have attempted, as much as possible, to avoid jargon so that the concepts are understandable by readers of diverse backgrounds. Throughout the

book, I refer interchangeably to the "client," "person," "patient" since these terms represent different models of approach, (i.e., medical, humanistic, educational, etc.). The reader will note an absence of the plethora of citations, extensive survey of the literature and convoluted structure of most texts. This has been done in order to fulfill the requirements of a brief and readable manual.

Many of the ideas are original, but many are derived from my associates and patients and from numerous articles, talks and workshops. For the occasions in which full and due credit was not given or some piece of information was omitted, please correspond with me so that I might rectify the problem in any future editions.

I would like to take this opportunity to express my pleasure and personal education in having been a part of the very exciting and vital early development of biofeedback with such people as Barry Sterman, Erik Peper, Joe Kamiya, Chuck Stroebel, Elmer and Alyce Green, Ed Wortz, Tom Budzynski, Johann Stoyva, Gary Schwartz, Mel Werback, Barbara Brown, Dave French, Chuck Leeb, Ken Greene, Ken Pelletier, Dave Paskewitz, many of whom are now among my closest friends.

I wish to thank the following people for their invaluable assistance on the preparation of this manuscript and without whose urging and support, it would not have been written. First and foremost, I thank my colleagues at the Biofeedback Institute of San Francisco: Jim Anderson, Alan Brauer, Toby Decker, DeLee Lantz, Fred Lasker, Steve Locke, Ed May, Larry Meredith, Bob Mithun, Suzanne Sampson, Pennie Sempell, Leslie Tauber and Marilyn Taylor, for their input of time,

energy and expertise. From the early years of formation in which the Institute was just an idea, to the commitment of personal involvement and, to the staff meetings, training programs and personal friendships, we have functioned as a very effective and sharing group of individual practitioners, each giving to the other what was lacking. I wish to especially thank a recent addition to our group, Sol Hamel, for his major investment of time and effort in the revision and further development of the clinical research. His dissertation on data collection and evaluation of biofeedback treatment at the Institute represents a major portion of the clinical research section of this book.

I am also grateful to Pennie Sempell, and Chrys Rudolph and Nancy O'Donnell, for their sensitive criticism of many portions of the manuscript as well as typing and editing assistance.

Finally, I wish to acknowledge the various articles and correspondence, from which ideas were freely incorporated and compared, especially in the applications section. I hope you enjoy and get value from this edition as much as I have.

George D. Fuller

San Francisco, 1977

CHAPTER I INTRODUCTION

In this section, I will discuss what biofeedback is,what it does and something about its difference and similarities to meditation and relaxation. Also covered is a brief description of what is used and how it is used clinically. The chapter is able to stand alone and can be used as a reprint for those who ask "What is biofeedback?" It is followed by more detailed introductory comments and biofeedback history for the practitioner. (Definition revision by Pennie Sempell).

What is Biofeedback?

Biofeedback is the use of instrumentation to mirror psychophysiological processes of which the individual is not normally aware and which may be brought under voluntary control. This means giving a person immediate information about his or her own biological conditions, such as: muscle tension, skin surface temperature, brain wave activity, galvanic skin response, blood pressure and heart rate. This feedback enables the individual to become an active participant in the process of health maintenance.

"Biofeedback is the use of instrumentation..."

Biofeedback involves the use of specialized instrumentation. This instrumentation may be as simple as a hospital thermometer or as sophisticated as an electroencephalograph, an electronic device which measures brain wave patterns. The most important feature about the instrumentation, no matter how simple or complex, is that it tells the individual about the measurement which it just made. It is this important feature of measurement and immediate feedback which distinguishes biofeedback from other techniques which teach "relaxation" or "alpha control," but which do not involve feedback of actual physiological changes.

"...to mirror..."

Biofeedback instrumentation gives some information about the body. There are many ways to "mirror" this information so the individual understands what changes occurred or what condition exists. The information may be conveyed by use of a meter or light which the person watches, or by a sound which is heard, or even by the movement of a toy train! Whatever means are used, the critical point is that the person gets immediate information about his or her own body. With appropriate instrumentation anything which can be measured can also be fed back to the individual in some way.

"...psychophysiological processes..."

At any instant, there are innumerable minute changes occurring in our bodies. For example, there are fluctuations in muscle activity, brain wave patterns, heart rate, blood flow, hormonal and gastric acidity. Many of these changes are related to psychological factors, such as: stress, arousal, fear, sexual excitement, anxiety and relaxation. The term "psychophysiological processes" covers physiological conditions which are related to psychological factors. It is this interaction of the mind-body which underlies much of biofeedback training. Currently, there are four major psychophysiological processes which are measured and "fed back" to the individual. The brief descriptions below cover only the major conditions and, thus, are not inclusive of all psychophysiological changes which can be measured by biofeedback instrumentation.

Muscle tension and relaxation can be measured and fed back by the EMG, electromyograph. Sensors placed on the skin over a muscle will detect electrical activity of the muscle. More electrical firings indicate greater tension (activity). Subjectively, people often are not aware of areas which are tense until it becomes painful. Before EMG training, people usually cannot feel the process of increasing muscle tension or small changes toward relaxation. After training, one can learn to recognize when tension begins to increase, and when and how to relax. There are many sites where muscle activity is measured and the tension-relaxation changes fed back. The selection of the site of EMG training will depend on the type of symptom which is being treated. The use of EMG biofeedback is extensively applied in general relaxation training, neuromuscular re-education, stroke, cerebral palsy, temporomandibular joint pain, bruxism and other syndromes.

Arousal changes, due primarily to sympathetic nervous system changes, are measured by the GSR, galvanic skin response. It measures changes in sweat response on the surface of the skin, usually the hand. As it is used in biofeedback, the individual can get feedback on his or her own arousal system. GSR has been successfully applied in work with phobias, exploration in psychotherapy, guided imagery, stuttering, diagnosis and demonstration of mind-body interaction and asthma.

Brain wave patterns can be measured and analyzed by an EEG or electroencephalograph. The EEG measures small microvoltages of electrical activity of the brain cortex by use of sensors placed on the scalp. The measurement is converted and analyzed into particular brain wave frequencies and amplitudes. The frequencies are categorized into four major groups: Beta, Alpha, Theta and Delta. There are different subjective experiences which are associated with these major groups ranging from attentiveness or anxiousness (Beta), to more meditative and "daydreaming" associations (Alpha), to passive problem-solving and creativity (Theta), and finally sleep (Delta). We are never in any one "state," rather, there may be a predominance of one frequency and associated subjective experiences. EEG biofeedback can be useful in treating certain kinds of disorders including insomnia, pain, study problems, obsessive-compulsive and ruminative depressions and creativity enhancement.

Peripheral blood flow can be measured by measuring the temperature of the surface of the skin by use of TEMP, temperature biofeedback. Changes in the dilation or constriction of the peripheral vessels lead to changes in blood flow. For example, in a constant environment, skin surface temperature of the hands can fluctuate between 60-95 degrees. Minute changes in the skin temperatures are measured by a thermistor placed on the surface of the skin and fed back to the individual. Temperature feedback has been successfully applied in treatment of such conditions as migraine headaches, Raynaud's syndrome, peripheral vascular dysfunction, general relaxation and in psychotherapy. Among the other psychophysiological processes which are measured and fed back are blood pressure, heart rate and penile tumescence.

"...of which the individual is not normally aware."

Many of the changes which occur in our bodies are normally beyond our awareness. However, we can become more aware of many of these tiny signals. Biofeedback is one way to do this. There are other techniques. Swami Rama, for example, can change his hand temperature on the palm by 10 degrees, turning one side red and the other side blue. He can also "stop" his heart (actually a fibrillation where the heart beats about 300 beats/minute), which he calls a "dove in my chest." He did not use biofeedback to learn these things. Then how did he do it? Through long training in meditation and relaxation, individuals can learn to "quiet" down their bodies and minimize internal and external distractions so that they can "hear" the tiny signals of which we are normally not aware. Once Swami Rama could "hear" the heart beat signal, he was getting feedback and could thus learn control over the changes. (an interesting note; Swami Rama is reportedly taking nearly $10,000 worth of biofeedback equipment back to India. He said that while it took him 15-30 years, perhaps his students might learn in 15-30 days.)

Modern technology has developed biofeedback instruments which amplify the tiny signals so that they can be "heard" over the internal and external "noise." Years of training in "quieting" the body are not necessary to hear the signal and learning occurs more quickly.

"...and which may be brought under voluntary control..."

Many of the psychophysiological processes which an individual can learn to control voluntarily with biofeedback training were formerly believed to be beyond volitional control. Clinical and experimental work in biofeedback and studies of people like Swami Rama have clearly shown that volitional changes in such processes as muscle tension or relaxation, blood flow patterns, arousal, brain wave patterns, heart rate and blood pressure can be learned and retained without further need for instrumentation. The way that this learning occurs is by reinforcement of a change in the desired direction. The biofeedback instrument first measures the change and then tells the individual when even a tiny change occurred in the desired direction.

To illustrate how this learning takes place, let's look at a typical case. Mr. S. has tension headaches 2-3 times a week, usually in the evening and on weekends. After an initial baseline evaluation and medical history, he begins EMG training to learn to relax the muscles of the upper back and neck area, which usually become tense during the day and lead to the pain of the headache at night. The therapist places the sensors over the trapezius muscles, and explains to Mr. S. that he will see the EMG meter go up whenever the muscles tense and go down whenever the muscles relax. The therapist tells Mr. S. that he should simply observe the downward movements of the meter, noting that everytime the needle drops, he has relaxed those muscles more than they were before. At first, Mr. S. cannot feel when the muscles are relaxing a little or tensing more - in fact, it seems to be "out of his control," but every time he sees that meter

drop, even by a small amount, he knows that his muscles relaxed more. His brain stores this information. With repeated positive feedback of decreases in muscle tension, Mr. S. learns to "let go" of the tension. He also develops an increasing awareness of when he is relaxed or not. Even though Mr. S. does not know exactly how he is doing it, he has learned volitional control over his own muscle activity. He can abort the occurrence of the headache early. He now rarely has tension headaches.

Another example of this type of learning is the familiar experience of learning to hit the "bull's eye" with a dart. If we had to learn blindfolded without any knowledge of how close or far our throws had been from the center, we would have almost no chance of improving, but our eyes give us feedback. Instantaneously they tell us, "Oh, I threw a little too far to the right (or left)." With practice at throwing darts and getting feedback, we have a much better chance of improving than if we had been blindfolded. Yet, we don't really understand exactly which nerves directed which muscles in exactly what manner nor were we aware of just how our brain synthesized all the feedback information. Still, we can now hit the bull's eye and we have a greater awareness of how to do it.
Compared to Mr. S's case, the EMG is like our eyes in the bull's eye example. It gives us information we need in order to gain better control over something we wish to do voluntarily. Thus, biofeedback is essentially a learning technique that allows the individual control over some physiological and psychological processes.

"...feedback allows the person to be an active participant in health maintenance."

The use of biofeedback instrumentation is merely a means to an end. It is a very useful learning technique whereby the individual can learn better control over certain psychophysiological processes. The "end" is that the person can exercise this voluntary control without the use of instruments. Therefore, the goal is to learn to lower muscle tension, or blood pressure, or increase hand temperature, etc. whenever necessary (i.e., at home, in the office, on vacation, etc.). The therapist helps the client to integrate the biofeedback training to his or her daily living with various techniques including home practice exercises. The client and therapist will also discuss situations or relationships which are stressful and anxiety-producing so that the client has a more complete understanding of the psychological and physiological interactions.

The underlying philosophy of biofeedback is basically a return of responsibility for one's health to the individual. It is a self-control model and, thus, is different from the traditional medical model where responsibility is given to the doctor to take care of the illness with drugs, surgery or other "external" controls. For example, biofeedback can reduce or eliminate the need for drugs for a particular condition or eliminate the need for more drastic measures (such as surgery) as the person learns to gain control over certain conditions (e.g., hypertension). It allows self-control through increased awareness of stress responses and the ability to voluntarily control these responses.

Because psychological and medically related issues are usually involved in most cases where biofeedback is useful, it is important that clients seek consultation with licensed professionals in the health professions (psychologists, psychiatrists, physicians, physical therapists, etc.). These professionals should be experienced in the use of biofeedback in addition to their area of expertise. Professional societies have been established in some states which set standards for training professionals and assistants in biofeedback and which also provide educational services to the public. Persons interested in biofeedback services should contact the Biofeedback Society of California (San Francisco) or the Biofeedback Society of America (Denver, Colorado) or their state's society.

> "Biofeedback may well be the interface between medicine and psychology...a behavioral medicine."

History:

Early work in biofeedback -- even before the word was coined -- consisted of research with laboratory animals and experimental subjects and is found under titles such as visceral learning, instrumental training, operant conditioning, augmented sensory feedback or instrumental conditioning of autonomically mediated behavior. Research with laboratory animals by Neal Miller and others (DiCara & Miller, 1968; Miller, 1969; Miller & Banuazizi, 1968; Miller & Carmona, 1967; and Miller & DiCara, 1968) produced convincing evidence that the autonomic nervous system, previously considered automatic and unavailable to voluntary control, responds to instrumental conditioning and can therefore be brought under voluntary control.

At approximately the same time, several researchers were reporting their attempts to train human subjects to control peripheral vascular responses (Snyder & Noble, 1966), heart rate (Brener & Hothersall, 1967; and Hnatiow & Lang, 1965), alpha brain waves (Kamiya, 1968, and Kamiya, 1969) and other such "involuntary" physiological activities. The principle unifying these human studies is that the subjects were fed back information about their own physiological activities which are normally not within the realm of awareness. The subjects thus learned to modify or control these activities. Techniques based on this principle constitute the field now generally known as biofeedback.

Within the last ten years, biofeedback has established itself as a major new therapeutic approach. Two major factors share the responsibility for the growth of biofeedback and for the recognition it has attained. First, the instrumentation so necessary to these approaches has become much more sophisticated, refined, versatile and mobile while,at the same time, decreasing in both cost and complexity of use (Paskewitz, 1975; and Schwitzgebel & Rugh, 1975). Secondly, biofeedback techniques have been applied, successfully, to a very wide range of clinical dysfunctions. In some instances, the primary goal is simply to help a client gain control of a disordered function such as training one to stop subvocalizing while reading (Hardyck, Petrinovitch & Ellsworth, 1966) or training specific muscle groups in cases of spasmodic torticollis (Cleeland, 1973), or neuromuscular re-education in hemiplegics (Johnson & Garton, 1973), or temperature training for Raynaud's syndrome (Surwit, 1973), or heart rate conditioning for cardiac arrhythmia (Engel, 1973) or sensorimotor training for epileptic seizures (Sterman, 1973).

Most biofeedback treatments, however, aim at helping the individual to both master the disordered function and achieve, maintain and produce a general state of relaxation at will. This approach is exemplified by the treatments used for tension headaches(Budzynski, Stoyva, Adler & Mullaney, 1973), hypertension (Patel & North, 1975), migraines (Wickramasekera, 1975), chronic anxiety (Raskin, Johnson & Rondetvedt, 1973) and a number of other conditions such as phobias and insomnia (Budzynski, 1973). There have also been reports of the use of physiological monitoring in psychotherapy cases (Lang, 1971; Marcus & Levin, 1977; and Toomim & Toomim, 1975; Fuller, 1977).

While there is general agreement about the effectiveness of biofeedback in providing relief from some symptoms such as tension headaches, muscle re-education and elimination of subvocalization while reading (Blanchard & Young, 1974), the degree of success in treating other problems, although promising, still remains controversial and tentative.. Neal Miller (1974) has pointed out the need for better controls and longer-term studies in the treatment of migraines and epilepsy. Blanchard & Young (1974) also called for the use of more rigorous experimental methods in assessing the effectiveness of biofeedback as applied to migraines, cardiac arrhythmias, lowering blood pressure and seizure reduction. Katkin & Murray (1968) had previously found fault with studies of electrodermal responses, of peripheral vascular activity and of heart rate, mostly concerning inappropriate controls and systematic biasing effects.

Such research is taking place. For example, Johnson & Turin (1975) and Turin and Johnson (1976) reported firmer evidence of the beneficial effects of handwarming in the treatment of migraines, although long-term studies are still lacking. Biofeedback techniques, new and old, are undergoing close scrutiny as testified by the growing number of reports on biofeedback appearing in the literature. In fact, the proliferation of biofeedback studies and an ever-widening interest in the field have resulted in the publication of several new journals, bibliographies, books, annuals and convention proceedings, most of which were not published as recently as five or six years ago. In addition to these publications, numerous biofeedback workshops, training programs, conventions, associations (including a fast growing national association -

the Biofeedback Society of America) and treatment clinics provide evidence of the growing acceptance and use of biofeedback approaches.

> "Biofeedback is a major part of the holistic approach to medicine, psychology and education that emphasizes an integration of mind/body process."

Applied and Experimental Biofeedback:

The research taking place in the field of biofeedback is almost exclusively aimed at the relationship between specific treatments and specific syndromes. In some instances, this might involve the training of several modalities concurrently (Schwartz, 1975). However, the use of biofeedback in clinical settings is seldom as unitary a phenomenon as it is in the laboratory. In practice, when a client comes to a clinic complaining of severe tension headaches, the biofeedback therapist, after appropriate intake and diagnostic procedures, will begin training the client in the reduction of tension in the frontalis and elsewhere as indicated by the experimental work reported. In most cases, however, therapists will also attempt to help such clients discover the antecedents to headaches, the secondary gains resulting from the headaches, the client's usual responses to stressful situations and other such corollary, though vital, information. Additionally, many therapists will try to help the client achieve a general state of relaxation at will and to produce such a relaxation reponse outside the clinic. The approach in such cases might include, in addition to biofeedback procedures, some techniques from Jacobson's Progressive Relaxation (Jacobson, 1970), from Autogenic Training (Luthe, 1969), from Wolpe's systematic desensitization process (Wolpe, 1973) and/or from some forms of more traditional psychotherapies directed at insight, abreaction, etc. For example, therapists may wish to provide clients with the opportunity to express and work through hostile or unpleasant emotions if these feelings are believed to play a part in the occurrence or severity of the

headaches, as suggested by Adler & Adler (1976). Most therapists, in an effort to effect reasonable improvement in their client's conditions, will often combine elements from several approaches.

> "Biofeedback is not 1984 with man controlled by machine, but just the opposite. It represents man controlling machine in an effort to control himself."

CHAPTER II
INSTRUMENTATION

The Feedback Loop

The Display

Terms

- Signal To Noise Ratio
- Electrode
- Electrode Impedance
- Filter
- Input Impedance
- Amplifier
- Differential Amplifier
- Common Mode Rejection
- Artifact
- Amplitude
- Integrator

Technical Notes On Instrument Use

- Setting
- Batteries/Line Voltage
- Multimodal Feedback
- Concurrent Monitoring

Record Keeping

- Manual
- Chart Recording
- Multi-Channel Data Acquisition

Current Status of Major Biofeedback Instruments

Electromyographic Feedback	History
Electroencephalographic Feedback	Physiology
Skin Temperature Feedback	Measurement
Electrodermal Feedback	Procedure/Uses

Blood Pressure/Pulse Wave Velocity

Heart Rate/Cardiotachometer

Penile Erection Feedback

Video Tape Feedback (VTR)

Instruments From Common Device

- Thermometer
- Mood Ring
- Bathroom Scale
- Mirror

The Ideal Instrument

This chapter reviews the technical aspects of biofeedback instrumentation. A brief description of the relevant physiology , measurements, application and use of each major instrument is discussed.

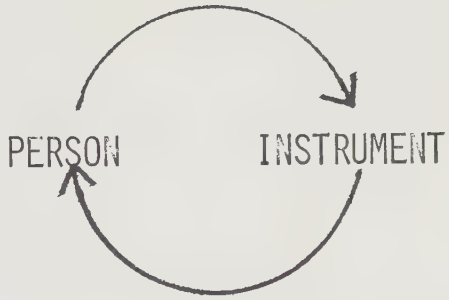
Problems of data acquisition and record keeping are also included in order to view in perspective the interaction of the person, environment, and instrumentation. The use of other instruments for biofeedback as well as videotape and "ideal" future clinical instruments are additionally discussed.

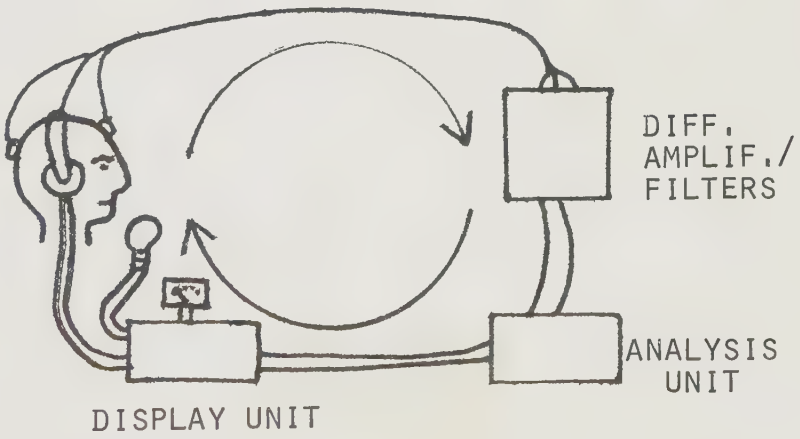
The Feedback Loop:

Biofeedback is the use of electronic instrumentation to monitor changes in physiological functioning, and the attempt to modify these functions are the basis of feedback. The feedback loop is represented by the person's interaction with the instrument. Included in the loop can be other variables such as the therapist or facilitator, the environment and background and the expectations of the person. The components of the loop are essentially: the physiological parameter being measured; an electrode (sensor); shielded leads to a differential amplifier; filters; an anlysis unit which can be set to give feedback of the desired limits; and a display unit which produces auditory, visual, tactile, or other, feedback in relation to the measured parameter. The loop is complete with the perception of the person.

The Display:

The display, whether visual or auditory, or other is of two types: analog, binary or digital. Analog feedback varies directly with the physiological signal. It may vary in AM or FM modes. In amplitude modulation (AM), i.e., the loudness, brightness or strength of the stimulus, varies in proportion to the changes in the measured parameter. In





THE BIOFEEDBACK LOOP

Frequency Modulation (FM), the pitch, the number of flashes or clicks, or the vibration rate may vary. With binary feedback there is no information on the intensity of change, but simply whether it has occurred or has passed a certain threshold. It typically is seen as: on/off; true/not true; above/below threshold; or increasing/decreasing. Usually visual, digital feedback transforms the signal into numbers which are displayed to the person.

Terms:

Signal To Noise Ratio (S/N): The ratio of the strength of the information signal to all other unwanted components. With a higher S/N ratio, the measurement more accurately reflects the parameter of concern. The relationship tells the purity of the signal.

Electrode (Sensor): The interfacing which connects the person to the machine, and thus transfers bioelectrical potentials produced by the body into electrical potentials for the instrument.

Electrode Impedance: The electrical resistance between electrodes that are in contact with the skin. The better the electrical contact, the lower the impedance, and the less the noise in the signal.

Filter: A device which limits the frequency response characteristics of the instrument. A digital filter has uniform gain within the bandpass and immediate cutoff. Special filters (such as 60 cycle) reduce interference within a specific bandpass.

Input Impedance: The resistance across the inputs of an amplifier. In biofeedback instrumentation a very high impedance (100-1000 times the electrode impedance) is desirable.

Amplifier: A circuit which changes a small signal into a larger one. The gain in amount of amplification is the ratio of the output to the input. A pre-amplifier is an initial circuit which is needed to amplify extremely small electrical signals (such as those in biofeedback) for the amplifier.

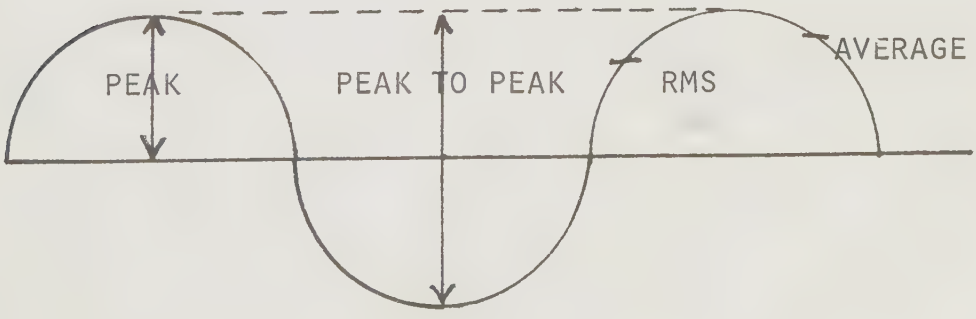
Differential Amplifier: An amplifier that amplifies only the difference between its inputs. A signal which is common to the two electrodes (unwanted) is for the most part eliminated. This is useful in reducing 60 cycle hum, for example, that may be present in both electrode input leads.

Common Mode Rejection: is the ability of a differential amplifier to reject signals in common to both inputs.

$$CMR = \frac{\text{Differential Gain}}{\text{Common Mode Gain.}}$$

Artifact: The presence of an unwanted signal(s) in the input of the biofeedback sensor. Examples of artifact include EMG signals from temporalis muscle or leg movements during EEG measurement.

Amplitude: The "strength" or size of the signal. It is usually measured in microvolts, but may be measured by different systems: peak, peak to peak, rms, or average.



Integrator: A device which measures the total energy over a defined time period.

Technical Notes On Instrument Use:

Setting: The location must be well shielded or at least free of radio, television, and other electrical signals. Most instruments are designed to operate effectively in nonshielded rooms, so that, unless you have a great deal of electrical interference, (e.g., X-ray unit on the other side of the wall; under a television tower; faulty florescent lights, etc.) there should be little interference.

To facilitate the client's progress it is best to have a very comfortable and nonthreatening environment. A home-like atmosphere, depending on one's own style, tends to relax the person and not carry the charge and anxiety associated with the more sterile, austere, antiseptic, and white-walled hospital. Comfortable chairs, such as soft recliners accelerate the training process. Low lighting, but sufficient to see the instrument meters, is preferred.

A comfortable, home-like, atmosphere is incompatible with high banks of stacked instruments and wires stringing everywhere. The potential usefulness of "being impressed with all the machinery" is greatly diminished by client's feeling like a "guinea pig in a laboratory". Thus, it is best to store the instruments out of sight, until they are needed. This can be accomplished by convenient cabinets or by bringing needed equipment from a central storage area.

Batteries/Line Voltage: Most biofeedback equipment is battery operated. When it is not battery operated it is important that it be optically or otherwise isolated in order to prevent shock hazard to the client. When using any line current equipment, such

as a chart recorder or light bank, in conjunction with the biofeedback instruments ; they should be interfaced with this safety precaution.

Multimodal Feedback: Multiple modality feedback involves the monitoring and displaying of several instruments simultaneously. This serves to integrate response patterns and coordinate training of different body systems. Generalized relaxation requires integration of psychophysiological responses. In addition, more information about the total psychophysiological profile is obtained.

After the initial training on single instruments, and when some control has been attained, it is best to begin to integrate and balance all available or relevant systems. This entails the use of two or more biofeedback instruments at the same time. This is possible through simultaneous feedback of each instrument. The simple, but less effective, method is presenting the feedback from each instrument using the same or different displays (e.g., one auditory/one visual). However, the more effective way is to present a single feedback tone or light (or other signal) when both instruments are changing in the desired direction. For example, it may be quite important for skin temperature to increase at the time that skin conductance decreases.

In an even more sophisticated form, the rate change is taken into account and the client gets feedback only for changes that are being made in the desired direction and with the desired speed or rapidity. In the future, biofeedback instruments which give any combination of rate change feedback by simply dialing that magnitude and combination will be readily available.

Concurrent Monitoring: During training with a single instrument it is important that other systems be monitored, both as a way to determine which other instruments may be of benefit, and to ascertain the concurrent changes that are occurring in other physiological systems. For example, in EMG training, temperature may be monitored and noted to increase. Yet, when the person uses Temperature feedback, he is unable to increase and continually decreases. One conclusion may be that the vascular system of that person is sensitive to the performance pressure and the effect is discouraging, but that peripheral dilation can occur more readily with direct EMG relaxation.

Ideally, for training to be most effective there should be integrated learning that draws together all systems. While this may be unfeasible, several different systems can be observed during the biofeedback training and the program adjusted in such a way that there is integration. The therapist's awareness and information about the changes that occur in biofeedback training provide another element in the importance of concurrent monitoring.

Record Keeping:

Manual Record Keeping: The use of standard forms (see Appendix) is the simplest and least expensive method of maintaining information about BFB training and patient progress. The recording of which instrument was used, the settings, special conditions, placements, and instructions are vital to the orderly progression of treatment. With various devices, different kinds of baseline and training limits are appropriate (e.g., average; integrated; or low point readings). With EEG the training limits, percent time and time intervals are also of importance. With EMG the exact placement, especially if nonstandard, is noted. With TEMP the room temperature and thermistor placement is entered (e.g., right or

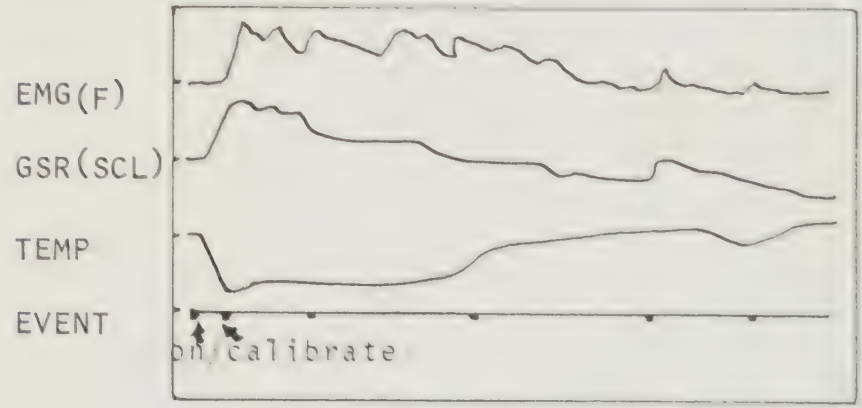
left hand, or other placement). With GSR the base resistance, variability, placement and sensitivity settings are important.

Such relevant information as: the goal of the session; name(s) of therapist(s); session date; plans for next session; and summary of session training results, are conveniently transferred to a summary of all sessions showing progress over treatment. This running record could be charted or graphed to continue to motivate the patient and to provide accurate feedback to the therapist as to the effectiveness of the procedures chosen.

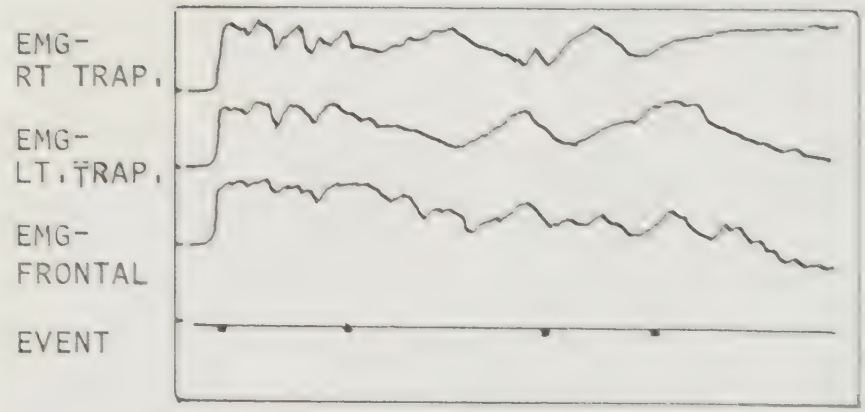
Chart Recording: A more precise and continuous record keeping is possible through the use of multi-channel chart recorders. This can be done in addition to the session information or integrated with it. The record can be placed directly in the client's clinical chart. The recording is capable of graphing several modalities concurrently and provides a clear and unmistakeable visual record of the training session. Changes in the training modality, the monitoring instruments, as well as the relationship between the instruments can be seen.

There are several moderately priced recorders that have the necessary features in the $1,500-$3,000 price range. The requirements include quietness, ease of operation, reliability, small size, and slow speed. The extreme accuracy and the rapid response time of multi-laboratory multi-channel recorders are not necessary in this application and is more expensive. The slow moving averages needed are best obtained with recorders that have extremely slow moving paper drives (e.g., 12 inches per hour). While inexpensive single channel recorders can be used, one loses the benefit of the relationship of several modalities for both the initial psychophysiological profile and training sessions.

EXAMPLES OF MULTI-CHANNEL CHART RECORDING OF BIOFEEDBACK MODALITIES USING AVERAGED OUTPUT



EMG TRAINING, GSR/TEMP MONITORING



MULTIPLE SITE EMG FOR NEURO-MUSC.

Multi-Channel Data Acquisition Systems: A typical system is able to provide read-outs of time averaged physiological activity, standard deviation, and percent time over several intervals. The printer can provide relevant data automatically at the end of a training session. Thus, several feedback modalities can be obtained with one patient or with a number of patients; modalities can be monitored centrally by one operator. This would appear to be a far cry from the sometimes tedious task of writing down all the information from fluctuating meters. The use of this system is limited only by cost considerations.

Current Status Of The Major Biofeedback Instruments:

EMG involves the monitoring and training of electromyographic activity associated with body relaxation, chronic muscle tension, and states of muscle dysfunction. It currently has the most general application of the four major instruments from general relaxation to specific muscle re-education.

Temperature has application in the monitoring and training of blood flow by using temperature as a measure of peripheral circulation resulting from vascoconstriction and dilation of the vessels. Associated with relaxation and sympathetic arousal it is helpful in Raynaud's syndrome, migraine, and other circulatory problems as well as providing a correlate to "resistance" in psychotherapy.

GSR, primarily through its most used variant of skin conductance, is the process of monitoring and displaying the electrical changes of the skin. It is of use in conditions associated with sympathetic arousal; as a demonstration device, in desensitization, and in exploration of conflict-laden material as in psychotherapy.

EEG is used in monitoring and training of electro-encephalographic activity associated with states of mental relaxation, arousal, stress, cognition, and sleep activities. At present EEG has somewhat limited clinical usefulness because of the current limitations of instrumentation.

MAJOR CLINICAL USES

EMG:	General Relaxation
	Phobic Desensitization/ Anxiety Reduction
	Tension Headaches/Neck & Back pain
	Essential Hypertension
	Bruxism/Temporomandibular Joint Syndrome
	Neuromuscular Reeducation/Stroke
	Cerebral Palsy
TEMP:	Migraine Headaches
	Raynaud's Disease/Peripheral Vascular
	Psychotherapy (resistance)
	Asthma/Hypertension
GSR:	Systematic Desensitization
	Guided imagery/exploration
	Psychotherapy
	Stuttering
	Asthma
EEG:	Insomnia
	Obsessive-Compulsive/Ruminative Depression
	Concentration/Reading Disorders
	Pain Reduction
	Epilepsy

Electromyograph Feedback

EMG History: Early work in the control of muscle activity centered around activation of single motor units (Basmajian, 1963). Using needle electrodes and feedback by means of an oscilloscope and loudspeaker, subjects learned to control the firing of different motor units within the muscle, vary the rate and even to produce various rhythm. (Basmajian, et al 1965).

Since then, many investigators have demonstrated the effectiveness of EMG feedback for whole muscle groups. Budzynski and Stoyva (1969) showed that subjects receiving auditory feedback for frontalis muscle tension significantly lower the microvoltage in three-twenty minute training sessions.

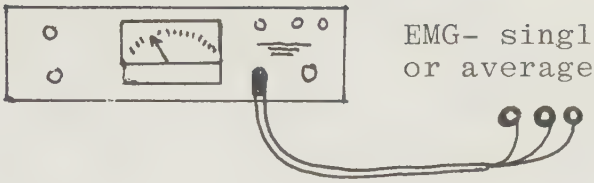
The EMG has long been a standard instrument in most physical medicine offices, but it has only recently been utilized by clinicians as a treatment rather than purely diagnostic instrument. Clinically, work has focused on two quite different areas: Neuromuscular re-education and general relaxation/ tension reduction.

EMG Physiology: The EMG measures the amount of electrical discharge in the muscle fibers and therefore it quantifies muscle contraction and relaxation. This electrical discharge is translated into auditory and visual displays and the person can begin to notice and bring about changes in muscle tension which he was previously unable to do.

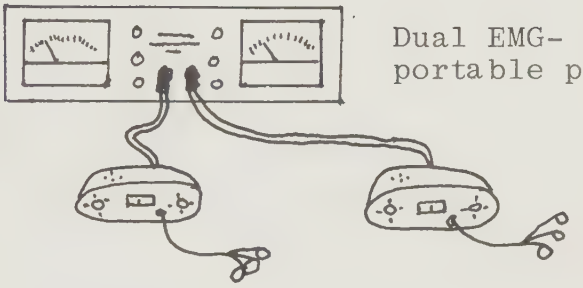
Since the microvoltage of EMG's is directly proportional to the mechanical muscle contraction, it is a measure of muscle relaxation and tonus. There is a desirable level of muscle tonus which can be exceeded (chronic muscle tension) or which is absent (neuromuscular disorders). Chronic muscle tension consumes considerable energy, leaving the person tired and fatigued.

EMG Measurement: The major placements of EMG electrodes have been the frontalis, trapezius and forearm. It is incorrect to assume that EMG biofeedback is synonomous with "Frontalis EMG Biofeedback" since frontalis represents only one of many possible placements. While frontalis and other foci may represent reasonable reflections of total body tension, it is entirely possible for the person to have learned to maintain low frontalis tension while holding chronically high levels in the rest of the body. It is impractical as well as inconvenient, however, to use dozens of electrodes over the entire body for accurate overall muscle tension assessment.

Recently, more work has been done with the more generalized wrist to wrist (or even ankle to ankle) placement. This allows a measure of upper or lower body tension respectively. One method in the wrist-wrist placement is to use a direct audio mode and have the patient reduce the sound sufficiently as to be able to detect heart rate in the audio signal. Using this relative amplitude criteria provides a built in goal in relaxation training.



EMG- single input
or averaged multiple



Dual EMG- with indept.
portable pre-amp units

Portable EMG
(Pocket size)
Single feedback tone

TYPES OF EMG BIOFEEDBACK INSTRUMENTS

EMG Procedure:
It is helpful to use a great deal of imagery in letting clients know how the biofeedback instruments work. In the case of the EMG, the patient may be told to "listen to their muscles underneath their skin" or to observe the tension level of those muscles when they are asked to tighten their muscles while seeing a deflection of the needle or hearing the raw signal. These changes in the biofeedback instrument are interpreted to clients as their being able to see or hear the muscle tension or activity underneath their skin at the site of the electrodes. This particular phrasing promotes a better association between the abstract movements of the needle or the crackling sound of the earphones and helps relate that activity to what the client is actually doing and thus experiencing.

"EMG allows the person to hear and see the muscle activity beneath the surface of the skin."

EMG Uses: Currently, the EMG is perhaps the most useful of all biofeedback instruments. This is particularly because it has two major areas of application: neuromuscular re-education and relaxation. Another reason is that within the relaxation area, EMG often provides the most effective initial awareness of the difference between tension and relaxation, and can accompany most all other kinds of biofeedback treatment either initially or concurrently.

EMG feedback can be utilized for increasing muscle strength, or for careful differentiation of muscular discharge within a functional movement or posture. Electrode placements are more specific and depend entirely on the muscle or muscle group where awareness of movement needs to be increased. Often, the muscle will be exercised in conjunction with the usual physical therapy regime, with the addition of EMG feedback. In the case of a muscle so weak that its contraction brings about no movement. EMG feedback is a valuable tool for motivating both patient and therapist to continue exercising, as in cases such as Bell's Palsy, early CVA, early post bone and muscle surgery, and such functions as head positioning in cerebral palsy. Functional disorders in the neuromuscular system also respond well to EMG biofeedback. Most investigators feel that in the cases of CVA and other central nervous system insults, EMG feedback assists in augmenting or restoring the deficient kinesthetic feedback loop in the servosystem of voluntary motor function. Thus, sensorimotor interaction of the closed-loop system is facilitated by audiovisual EMG display.

Simultaneous training of two opposing or complimentary muscle groups may combine the functions of relaxation and neuromuscular re-education. For example, in torticollis, one sternocliedomastoid (and/or trapezius)

may have to be strengthened and the other trained to relax. In conditions like scoliosis, one section of back muscles may be strengthened to straighten the spine and others to relax. Persons with shoulder and rib breathing, common in chronic back pain where this has replaced diaphragm breathing, can be taught to reverse the muscle use. The most common use-application of the dual use of EMG is the flaccidity-spasticity combination of the CVA limb, where often the weakness of the extensors is further inhibited by the spasticity of the flexor.

"A biofeedback instrument is a passive monitor, like a radio. It doesn't do anything to you or for you. It just tells you what <u>you</u> did."

Electroencephalographic Feedback

EEG History: The presence of electrical current in the brain was discovered by an English physician, Richard Caton, in 1875. It was not until 1924 that Hans Berger, a German neurologist, used his ordinary radio equipment to amplify the brain's electrical activity so that he could record it on graph paper. Berger noticed that rhythmic changes (brain waves) varied with the individual's state of consciousness.

The various regions of the brain do not emit the same brain wave frequency simultaneously. An EEG electrode placed on the scalp would pick up many waves with differing characteristics. This has presented a great deal of difficulty to researchers trying to interpret the large amount of data they receive from even one EEG recording. Brain waves have been categorized into four basic groups: alpha, beta, theta and delta waves. Although none of these waves is ever emitted alone, the state of consciousness of the individual may make one frequency more pronounced than the others.

Clinically, the EEG has been employed in diagnosing brain tumors and epileptic seizures. While in research, it has been used in sleep and dream studies. Observations that persons skilled in meditation show high levels of alpha activity during their practice led to research investigations of the relationship between subjective experiences and alpha. Biofeedback approaches question the possibility of achieving these same subjective states by increasing alpha activity. Kamiya (1969) observed that subjects can increase and decrease both the amplitude and the frequency of alpha when given auditory binary feedback. More recently, Kamiya suggests that continuous feedback is more effective than binary feedback.

Controlled studies using binary feedback with eyes closed reported significant increases in alpha when compared to control groups. (See Appendix for EEG biofeedback research outline).

EEG Physiology: Although there is no conclusive evidence to indicate what causes brain waves, there have been attempts to identify the processes involved. That rhythmic activity is generated by thalamo-cortical circuits has gained widespread neurophysiological support. Andersen and Andersson (1968) have stated that the available evidence indicates that the thalamus is the originator of thalamocortical rhythmic activity. The thalamic control over the cortical rhythms suggests that their investigation should be aimed at the thalamic mechanism.

The EEG appears to arise from pre-potentials set up on dendritic trees at multiple afferent synapses. The cortex is modulated by all primary sensory pathways (i.e., visual, olfactory, auditory, somatosensory), non-specific sensory pathways from the reticular formation and coordinating motor pathways from the cerebellum and extra-pyramidal system. There is considerable branching where the nerve fibers enter the cerebral cortex and the incoming pulses are spread over large areas of cortex. Because of the branching, impulses traveling along a single primary nerve fiber can affect thousands of neurons (Cooper, 1969).

Thus, brain waves are a product of electrochemical activity in the brain cells. EEGs normally record this electrical activity from neuronal units in the outer cortical mantel of the brain, which is under the control of the reticular activating system. The firing at the synapse provides the electrical activity. Where there are few axons firing in unison in one area of the brain, a low amplitude is registered by the EEG. When many cells are firing

PRIMARY EEG RHYTHMS

RHYTHM NAME	DOMINANT FREQUENCY (HERTZ) AND AMPLITUDE (uV)	PSYCHOLOGICAL CORRELATE
BETA β	12-20+ HZ (LOW AMPLITUDE)	AWAKE, AWARE, ATTENTIVE, ACTV CONCENTRATION, ANXIOUS, HIGH AROUSAL FOCUSED ATTN ANTICIPATORY, THREATENED.
ALPHA α	8-12 HZ 20-100+ uV	RELAXED, MEDITATIVE, LOW AROUSAL, NON-FOCUSED, BLANK MIND, CALMNESS, PASSIVE ATTENTION, SERENITY
THETA θ	4-8 HZ	HYPNOGOGIC & HYPNO-POMPIC IMAGERY, TWILIGHT STATE DAY-DREAMING LOW AROUSAL
DELTA Δ	.5-4 HZ	ASSOCIATED WITH DEEP SLEEP, LOWEST MENTAL AROUSAL

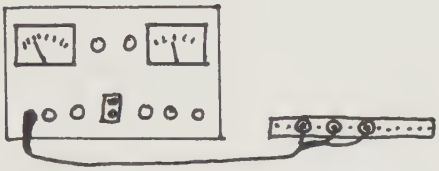
in unison a high amplitude brain wave is recorded. Synchronous firing of cortical cells in groups yield measurable waveforms. Brain waves are typically perceived as oscillating potentials ranging from less than one to as many as fifty cycles per second (Hertz). The frequency has been found to correlate with specific subjective states in humans (See chart).

EEG Measurement: The purpose of the electrode is to make a connection between the conduction fluid of the tissue in which the electrical activity is generated and the input circuit of the amplifier. There are two major types of electrodes: silver-silver chloride and sponge. The metal electrodes are either discs or cups which are held in place by a band or adhesive and in which a conductive solution (typically electrode paste or cream) is used. The sponge type requires a salt solution for conduction and consists of a soaked sponge pad surrounded by a rubber epoxy cap and held on the scalp by a headband.

In applying electrodes the scalp should be clean for good electrical contact, especially if the hair is oily. A soft elastic and velcro band effectively holds the electrodes for most standard placements,(for occipital, parietal and frontal locations on either hemisphere). While single cortical and intracerebral electrodes can get a totally different reading when they are moved even 1mm., the scalp EEG readings are the average of various cortical areas.

Movement and artifact are particularly pronounced in EEG biofeedback. Care should be taken to have the person be quite still while training and to observe for minute eye and muscle twitch. In spite of artifact inhibit circuits, it is possible on

EEG-digital filter wh noise/tone fdbk percent time meter



EEG- analog filter tone feedback, band selection

EEG- Alpha/Theta Trainer, % time meter, tone

Portable EEG- Alpha Trainer sound feedback

TYPES OF EEG BIOFEEDBACK INSTRUMENTS

many EEGs to produce what appears to be "alpha" or "theta" waves by various maneuvers such as rolling the eyes upward and fluttering the lids or producing facial muscle twitches. A useful indicator of these artifacts is the sudden rise in amplitude on the meter.

EEG Procedures: Alpha/theta and EEG shaping are two aspects of EEG biofeedback. The person is instructed to close his or her eyes to prevent distractions and reduce visual attention that inhibits occipital alpha. Typically audio feedback is used (clients seem to prefer white noise). The client is given a sample of the sound that he is to expect to hear when producing the desired frequencies and then asked to sit quietly. The instruments most commonly used show frequency and amplitude on the meters. The upper frequency limit threshold is set at the point at which the person gets a feedback sound 50% of the time. This allows shaping or tracking of the frequency. The lower frequency threshold is set approximately 4Hz below in order to obtain a range "window" with adequate feedback. The amplitude limits are set so that the lower threshold is just below the average produced by the person (often about 20uV), and the upper limit well above the highest brain wave amplitude, (about 60uV is often useful). This allows an amplitude window which excludes noise and most muscle artifact.

The client receives feedback when the combination of frequency and amplitude is within those limits set (i.e. within the "window"). Too high or low frequency or amplitude results in no feedback. As the person gets more and more feedback (learns), the upper frequency limit is reduced(or the range lowered) to shape lower frequencies. Thus, the feedback limits are periodically readjusted to

progressively lower frequencies and higher amplitude ranges. Large bursts of high amplitude seen on the meter most likely signify muscle artifact instead of increases in brain wave amplitude.

Uses: While EEG is limited at present to a very simple combination of frequency and amplitude as measured by one set of electrodes, the newer power spectral analysis should allow a very sophisticated feedback of any combination of frequency and amplitude occurring at the moment and in both hemispheres. It should be only a matter of a few more years before such devices are available, once the technology has been accomplished. Currently, EEG has very limited clinical usefulness. It is most useful in those areas in which mental relaxation or quietness, enhancing concentration and attention, or shifting of awareness generally is beneficial. Thus, in some cases of relaxation, in reducing obsessive compulsive or ruminative thoughts, in facilitating sleep (as in insomnia),and in improving attention and concentration (as in reading disabilities); EEG biofeedback may be useful.

The work done earlier by Kamiya,Mulholland and others involved basically alpha training instruments in use now are limited for the most part to this kind of frequency interval training. The EEG is clinically useful for a few basic conditions.

Mental relaxation for people who cannot sleep although muscularly relaxed is one major application. Those who have "unlearned" the process of falling asleep often benefit from shaping EEG frequencies toward sleep. It is done usually in combination with EMG and relaxation training. The shaping procedure is straightforward and involves training by successive approximation downward in frequency

towards alpha. I first treated a cardiologist for insomnia with EEG. In 16 sessions he learned how to fall asleep in my office within 10 minutes, and showed improved home records. An early mistake was providing low theta/hi delta feedback which kept waking him. That was easily corrected by eliminating the feedback at 4Hz.(See Clinical Applications Chapter for more detailed description).

We have found alpha training to be helpful for obsessive-compulsive and ruminative depressives; those individuals who have thoughts and worries in their mind and cannot "let them go"

Concentration and attention difficulties require a procedure of alpha training followed by alpha suppression. In problems of concentration, memory, and reading, individuals can benefit from enhancing the differentiation between alpha and beta. It is not alpha training, in this case, it is learning of alpha suppression. To date, these methods are simplistic ; when EEG moves to a whole new level after development of spectral analysis, it will be more applicable.

There are occasions when alpha EEG is helpful in reduction of chronic pain. The person develops a mentally relaxed, quiet period, and defocuses the awareness of pain. The vi pain cycle involves the person tensing-up in response to the pain, which then exacerbates the pain itself. This procedure interrupts the cycle by quieting the intense focus so that relaxation can occur and the originating pain may be reduced or non-existant.

Theta training has not been effective in our experience. It is difficult to train for theta; and when trained it does not effectively enhance subjective feelings of creativity in people who see themselves

as creative. They report no difference in their artistic productions. There have been some positive subjective reports by people who do not particularly see themselves as creative. They report that training seemed to enhance their creativity and allow more passive problem solving to occur. Generally, we have not seen appreciable differences in theta production between people who see themselves as creative versus those who do not.

Skin Temperature Feedback:

TEMP History: Investigations of skin temperature and blood volume modification consistently show that vasomotor activity can be controlled using biofeedback. In controlled studies, Steptoe et al (1974) used visual and auditory feedback to get significant differential changes in earlobe temperature. Three well-known studies by Sargent, Green and Walters (1972, 1973, 1974) at the Menninger Foundation have used skin temperature with migraine headache control. The results are impressive because of the difficulties in treating migraine by other means; however, no adequate controls were used. Wickramsekera (1973) first used frontalis EMG for 18 sessions, then a 3-week no-treatment baseline period, followed by hand temperature training with 2 migraine patients. He found reduction in headache frequency and intensity and medication throughout a 3-month follow-up. Surwit (1973) presented evidence of temperature training in combination with other procedures for Raynaud's Syndrome, in which 4 patients showed improvement. Turin & Johnson (1976) studied 7 migraine patients in an effort to deal with criticisms of earlier work. Headache activity was substantially reduced in subjects who did warming, and activity remained at baseline or increased in subjects who did cooling despite positive therapeutic expectations. They

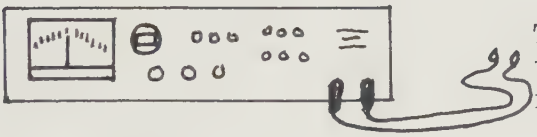
showed that finger temperature training, without autogenic training, was effective in reducing migraine activity independent of suggestion effects.

TEMP Physiology: Given constant internal(core) body temperature and environmental (room) temperature, peripheral skin temperature is regulated by vasomotor control mechanisms. The body responds to environmental temperature changes, through a thermoregulatory response, by constriction or dilation of the smooth muscles around the peripheral blood vessels. If external temperature decreases then constriction of peripheral vessels and consequent reduction of skin temperature allows increased blood flow to internal organs and maintenance of constant core temperature.

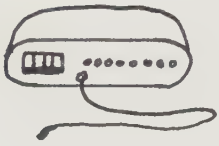
Bio-chemical factors influencing skin temperature are alcohol, tobacco,histamine, epinephrine, lactic acid, and carbon dioxide . Psychological factors influencing skin temperature include emotional stress, anxiety and environmental stimuli. An autonomic/sympathetic response to such stimuli results in changes in cardiac output, arterial blood pressure, and peripheral vasomotor activity.

Sympathetic and endocrine activation result in vasoconstriction in the hands and feet as the smooth muscles contract around the blood vessels, thus reducing their diameter. Given constant conditions, skin temperature is directly related to peripheral circulation. An increase in skin temperature can reflect a relaxation of the sympathetic N.S.

Although a very useful modality, TEMP training is rather indirect. Heat flow is dependent upon blood flow,which is determined by the constriction and dilation of peripheral vessels regulated by the smooth muscles which are controlled by the sympathetic branch of the autonomic nervous system.



TEMP- Multiple input thermistors and feedback modes



Digital TEMP- with lightbar tone and 1/100 resolution

Portable Wrist TEMP Trainer, light & adjust

TYPES OF TEMP BIOFEEDBACK INSTRUMENTS

TEMP Measurement: A thermistor placed on a distal digit (which is most responsive to the stress stimuli) allows measurement of the skin temperature changes. Care should be taken not to train too specific a response by using multiple thermistors at several fingers and both hands. With both visual and auditory feedback, temperature changes are denoted in .1 degree increments on a meter or digital screen, and in a rising or falling tone. The thermistor can be placed on any skin surface, but the fingers are the most common site.

A tape or velcro band is used to attach the thermistor to the finger. It is placed in such a way that circulation is not restricted. It is not effective to hold or pinch the thermistor between fingers or against the thigh; what is sought is change in temperature(blood flow) not artificially high absolute temperatures created by an "oven effect". In the same way, avoid insulation around the thermistor. It is not temperature, but change in temperature that is the target measure.

TEMP Procedures: After the instrument and method of measurement are described, the person is instructed to simply be comfortable and observe any changes in the movement of the meter or sound. If TEMP decreases, it is good to say,"That is one direction of temperature change, continue to observe and perhaps there will be also a movement in the other direction". Without this accepting attitude it is common for the person to get caught up in a performance effort of trying and become frustrated as the hand TEMP continues dropping while expecting warming.

In order to facilitate the process initially, imagery and relaxation procedures are often useful. It could

be suggested that the person visualize their hands in warm water, a warm glove, or in an electric heating pad. They might see themselves on a warm sunny beach, or warming hands by a fire in a rustic cabin, or holding a glowing warm light. The natural sensations can be involved in the visualization by focusing on the pulsation or tingling in the fingertips, the heaviness of the arms and hands, and the warmth spreading down arms from inside the torso. When these images are difficult, a blanket or increase in room temperature may be necessary to "get the person started", and overcome the resistance or concept of failure.

The glowing green-yellow-red or the sequential light feedbacks available on some instruments are especially helpful in that the association can be drawn to allowing the hands to "glow red hot". The person can practice at home by doing relaxation exercises and noticing changes in the color of "mood rings"(available in some department stores) or on a wrist-temperature training unit. By daily observing changes in the hand TEMP one becomes more aware of stress and relaxation episodes and the relationship to internal and environmental events. By putting the hand to the face, even the person who has difficulty in observing relative hand TEMP can soon become quite accurate in their perceptions. The migraine patient typically has never noticed the relationship between coldness of hands and the onset of the headache. The student may not have seen as important the awareness of cold hands just before giving a talk in class. Yet these observations not only increase awareness of psychophyiological (mind-body) relationships. but also enhance generalization of the biofeedback training to everyday experiences. It is common to have a client report that doing mini-hand-warmings several times each day, and noticing significantly

warmer sensations coincide with calmer feelings. (The "time-out" periods for hand-warming relaxation trigger the quieter internal state, resulting in warmer hands from peripheral dilation and greater blood flow,i.e. the warm hands do not "produce" the relaxation, as is commonly misunderstood).

In actual training it should be pointed out that control can be quite localized. One hand may increase while the other does not; the finger on which the thermistor is placed increases and the rest of that hand does not; or the distal digit can warm while the rest of the finger does not. This specificity may require sequential placement or multiple (avg.) thermistors placed on several fingers of both hands either for monitoring concurrent changes or for training.

It is also possible for temperature higher than normal core to be obtained by extensive training. While the mechanism is not understood, the observation was made by both the author and chief engineer, who both obtained reliably measured temperatures of greater than 100 degrees, experiencing feelings of light-headed dizziness and a generally euphoric "high". These observations were replicated with a hospital thermography unit, showing the patterns of heat flow (photographed). The results are preliminary, but indicate a distinct sequential progression of vascular dilation during a training episode.

TEMP Uses: Temperature, a seemingly simple instrument, is a window to autonomic functioning. Although the device may be nothing more than an electronic thermometer with some additions, the mechanism is a very important and exciting one. Blood flow, which is influenced by the constriction

or dilation of peripheral vessels, is measured by temperature changes at the skin surface, thus giving an indication of the degree of autonomic response. In addition to the application of TEMP training to circulatory disorders such as migraine, Raynaud's Syndrome and other circulatory problems; temperature feedback can be very useful in psychotherapy for giving information about the patient's resistance. The same correlate is useful in relaxation groups or relaxation training in that as the patient relaxes hand TEMP would be expected to increase. If the patient reports feeling subjectively very peaceful and relaxed, and yet maintains peripheral resistance, he or she may not be relaxing completely.

We have used skin TEMP feedback in a variety of conditions in which sympathetic activation is implicated, such as asthma. (See Clinical Applications for an extensive discussion of a 5-year old girl who received TEMP training in her sucessful control of asthma symptoms.).

Electrodermal Feedback:

GSR History: An often misunderstood and difficult technique, GSR has gone through many phases of interest and rejection since the early 1900's. It has been used in important research on anxiety and stress (Fenz & Epstein, 1967); it has been a part of lie detection (Raskin, 1973); and it has been the basis of a cult organization in which "auditors" "clear" members. Controversy has centered around the technique, underlying mechanisms, and the meaning of the responses obtained from the skin.

There has been a long history of electrodermal activity research, most of it dealing with spontaneous fluctuations. Most investigators accept the phenomenon without understanding exactly what it means (Hume, 1976). Although GSR "Galvanic Skin Response" is the oldest and yet most confusing term, it is also the one in common use. Many attempts have been made to improve and update the terminology; two such systems are proposed by the Society for Psychophysiological Research (Brown,1967), and Venables & Martin (1967). Electrodermal response (EDR) is the umbrella under which the terms fall. (See chart, page 54.)

Basically there are two techniques in the history of Electrodermal measurement. In one a current is passed through the skin and the resistance to passage is measured; in the other no current is used externally and the skin itself is the source of electrical activity.

GSR Physiology: Easily measured and relatively reliable, GSR has been used as an index for those who need some measureable parameter of a person's internal "state". As in EEG, there is not a clear

GSR TERMINOLOGY

WHEN REFERRING TO GSR, I AM USING THE TERM ONLY TO DESCRIBE THAT CLASS OF INSTRUMENTS BY THE MOST COMMONLY ACCEPTED TERM. I HAVE FOUND SKIN CONDUCTANCE TO BE THE MOST USEFUL MODE IN PRACTICE. THUS, THE GSR THAT I REFER TO IS THE MEASUREMENT OF SKIN CONDUCTANCE LEVEL (SCL).

THERE ARE A PLETHORA OF TERMS USED TO VARIOUSLY DESCRIBE THESE PHENOMENA. THE FOLLOWING LIST SERVES TO EXEMPLIFY THE CONFUSION OR PERHAPS CLARIFY THE DIFFERENT MEASURES:

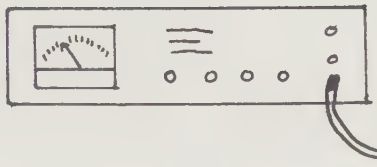
GSR = GALVANIC SKIN RESPONSE
EDR = ELECTRODERMAL RESPONSE
PGR = PSYCHOGALVANIC RESPONSE
SCR = SKIN CONDUCTANCE RESPONSE
SRR = SKIN RESISTANCE RESPONSE
SPR = SKIN POTENTIAL RESPONSE (PHASIC)
SZR = SKIN IMPEDANCE RESPONSE
SCL = SKIN CONDUCTANCE LEVEL
SRL = SKIN RESISTANCE LEVEL (TONIC)
SPL = SKIN POTENTIAL LEVEL

understanding of what the measures reflect. Physiologically, the GSR reflects sweat gland activity and changes in the sympathetic nervous system, as well as peripheral nervous system and measurement variables. Measured from the palm or fingertips, there are changes in the relative conductance of a small electrical current between the electrodes. The activity of the sweat glands in response to sympathetic nervous stimulation (increased sympathetic activation) results in an increase in the level of conductance. There is a relationship between sympathetic activity and emotional arousal, although one cannot identify the specific emotion being elicited. Fear, anger, startle response, orienting response and sexual feelings are all among emotions which may produce similar GSR responses.

GSR Measurement: The changes in the electrical characteristics of the skin are related to meaningful stimulation. It is measured typically from the fingers or palmar areas using either silver-silver chloride electrodes and conductive cream, or, with silver impregnated cloth electrodes which are attached without cream to the fingers with velcro strips. There is a latency of 1-2 seconds and a return to original levels of response usually within 5-20 seconds.

Factors influencing measurement of the GSR response include such variables as: hand-washing; environment temperature and humidity; age; sudden inhalation; movement; pressure against the electrodes; nicotine and alcohol intake. (Venables and Christie, 1973).

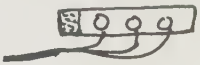
GSR Procedure: After attaching the electrodes, the client is asked to remain physically quiet and observe the meter and/or sound. Various stimulus conditions are presented, such as: loudly clapping the hands in front of the client; asking the client to take a deep breath and hold



GSR, EDR/SPR with
multi-features

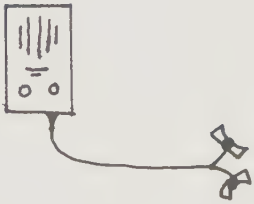
Ag-Ag Cl Electrodes, handset

GSR, Conductance
Baseline, auto-reset



Silver cloth
finger strap
electrodes

Palmar electrodes
velcro band



GSR device
Variable sound or meter

Metal button
finger velcro
straps

Metal cans
held in hands

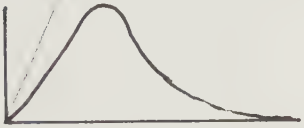
TYPES OF GSR BIOFEEDBACK INSTRUMENTS

it; asking the client to think about or visualize an upsetting thought or experience. The patterns of GSR conductance changes are observed, noting in particular the initial level, rapidity of increase and decrease, and amount of change. These characteristic changes in arousal reflect a particular person's style and ability to deal with stimulation. (Frequent response patterns are illustrated in the Figure on Page 58.).

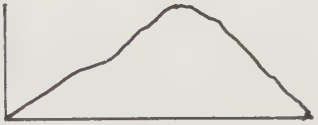
The GSR is a particularly good device for early demonstration of the mind-body interaction. After placing the electrodes and noting changes in arousal in a resting state, the hand clap usually produces a startle response and the conductance change clearly demonstrates the increased arousal. The client immediately begins to see the connection between suprise and a physiological occurrence that happens to be measured at the fingertips. As the client returns to a resting state, notice the characteristic patterns. The meter will indicate a return to resting baseline, showing a recovery from the startle or may remain at a high level of arousal, perhaps even increasing as though there were aftershocks of the original response. Other characteristic patterns may be seen.

After the client has lowered the arousal sufficiently, he is asked to think of something which is unpleasant or upsetting to him. It may be whatever scene is the most disturbing one he can think of at the moment. Once again there will most likely be a characteristic response, possibly a dramatic rapid increase in skin conductance. The person is asked to remain with the thought or scene and observe the arousal as it either increases plateaus, or even begins to decrease again depending on the person's response style. Statements such as "Your thoughts

RAPID RESPONDER-
SLOW RECOVERY



RAPID RESPONDER-
RAPID RECOVERY



SLOW RESPONDER-
SLOW RECOVERY

SLOW RESPONDER-
RAPID RECOVERY

MINIMAL OR
NON-RESPONDER

LABILE RESPONDER

GSR CONDUCTANCE PATTERNS (RESPONSE CHARACTERISTICS) REFLECTING PERSONALITY TYPES

and feelings are occurring all over your body, even at your fingertips" and "Stresses,fears, anger, etc. produce changes throughout the body including your heart, stomach, lungs, muscles, and skin" help to draw together the relationships in the vitally important process of cognitive restructuring that occurs in early stages and throughout therapy with biofeedback. It is this cognitive work that allows the biofeedback process to be meaningful and to generalize into everyday life. It gives the client a conceptual framework with which to look at his or her life in general and their symptoms specifically.

The symptoms then are no longer foreign or alien to them and being imposed upon them but something which is produced as reactions to the events around them and their inner feelings. Without this kind of cognitive restructuring, the process of biofeedback might be isolated from the whole of life and might even be misinterpreted as "working with a machine that will reduce your symptoms by sitting in a room and watching a needle move."

GSR Uses: The use of GSR falls into several categories: 1) As a demonstration tool to make vivid the correspondence between mind and body as discussed above. 2) In determining the characteristic patterns of responders. There is an intriguing, although not clearly demonstrated relationship between the conductance patterns obtained and personality types. This tentative evidence reflecting characterological patterns of response may serve as a starting point for the greater application of GSR into psychotherapy with biofeedback. A labile responder might learn how to become less emotionally reactive to the events of the world, or a person who is slow to recover from a frightening stimulus may learn to return to a state of equilibrium.

3) For desensitization, both in its systematic and spontaneous forms, to reduce the charge placed on a certain event or emotion. Phobias, anxiety, and some specific concerns can be treated in this way. The GSR is used both in formulating and ordering the hierarchy, giving each item a value, and in the actual desensitization process itself. An index for the evaluation of the level of fear and the return to a lowered arousal is available beyond the subjective evaluation. 4) In the lowering of sympathetic arousal as applied to a number of different conditions. Hypertension, asthma, stuttering, and hyperhydrosis are but a few. 5) Exploration in psychotherapy, guided imagery, and hypnosis. The therapist becomes part of the biofeedback loop in which information concerning a particular content is pursued on the basis of a more integrated response pattern which adds physiological emotional arousal to the already visible postural, non-verbal cues.

"GSR is not a lie detector anymore than a knife in the hands of a cook is necessarily a weapon."

Blood Pressure Feedback:

Blood Pressure History and Use: The non-clinical research studies show small changes in blood pressure can be achieved by normotensive subjects (usually college students) (Shapiro, Schwartz and Tursky, 1972). The difficulty in clinical studies is the criteria for what denotes hypertension, and use of an adequate extended baseline. Benson, et al. (1971) and Goldman, et al. (1975) found 17 mm. Hg. decreases in 25 daily and 9 weekly sessions respectively. Diastolic blood pressure reductions have also been found (Deabler and Dillenkoffer, 1973). Other studies (e.g., Elder & Eustis, 1975) show within session changes but no progressive between session changes. Kristt & Engel (1975) found that all hypertensives studied could produce reliable SBP decreases and most could also increase.

Redmond, et al. (1974) found no difference in blood pressure reductions between verbal feedback and blood pressure feedback; and Shoemaker and Tasto (1975) found relaxation training produced greater changes than feedback. The latter study also found that diastolic blood pressure decreased more in both groups than the no feedback control group.

The evidence to date would indicate that relaxation training is at least as effective in reducing blood pressure than blood pressure feedback per se. Considering the difficulty in measurement as discussed in the next section, clinical work with hypertension is best accomplished at present with relaxation and EMG/GSR/TEMP biofeedback procedures.

Blood Pressure Measurement and Procedure: It has been difficult to get immediate and continuous feedback for blood pressure. Standard sphygnomanometers are slow and cumbersome. Automated cuffs which inflate periodically result in delay of feedback information for efficient learning. In addition, the continual inflation cycles distract the person and the automated equipment is expensive and the readings somewhat inaccurate.

One technique that makes it possible to use a relatively inexpensive electronic blood pressure cuff is to inflate to median systolic blood pressure and if fewer than half the beats are heard (light flashes), then reduce the cuff pressure. The flashes can then track the SBP downward. However, this technique is subject to some artifact.

Pulse Wave Velocity (PWV): a technique which does not use an inflated cuff but instead sophisticated electronics to give analog feedback on a beat to beat basis, may prove to be a breakthrough in this area. (Steptoe, et al.1976). It works by measuring of the velocity of the cardiac pulse wave down the arm artery (sensors pick up the bracial and radial pulse). The higher the velocity of the pulse wave, the higher the blood pressure. PWV reflects blood pressure changes and is felt to be linearly correlated. However, it is a complex variable made up of many components and is now the subject of ongoing research. Differences in arm length and artery elasticity prevent direct translation of PWV into mm. of Hg. readings, but can be calibrated to mean arterial blood pressure. Using this method, blood pressure is monitored and PWV becomes the feedback component.

Heart Rate:

Heart rate studies are replete in the autonomic modification literature. It has been possible to produce significant heart rate level changes in even a single session, although it has been easier to get increases than decreases. There is a great deal of evidence to show that subjects can quite easily produce voluntary changes in both heart rate level and variability in multiple sessions (Engel and Hansen, 1966; Hnatiow and Lang, 1965). Heart rate training with premature ventricular contractions, atrial fibrillations and Wolff-Parkinson-White syndrome have been investigated (Engel, 1972). Heart rate feedback along with desensitization and implosion has been applied successfully to the management of anxiety about the heart (Wilkramaskera, 1974).

Clinically, heart rate training may be applicable in cardiac arrhythmias of many causes. The method involves an alternation of heart rate speeding and slowing, and, for obvious reasons, is best done in an in-patient coronary care setting.

Penile Erection Feedback

Using a mercury strain gauge loop in which change in penile tumescence is fed back by corresponding click rate, it is possible to do voluntary erection control. This technique has been applied in behavior modification cases both for reduction of erection (e.g., while listening to pornographic material) and for increase of erection while watching sexually arousing slides, and was used with homosexuals to increase heterosexual arousal. The technique has application for biofeedback in cases of lowered sexual arousal such as impotence. In the context of a complete sexual and counseling treatment, it should be regarded as an approach to be used later in treatment, if needed. When the sexual dynamics in the interaction of the persons involved, mutual exploration, visualization and GSR feedback are all explored, then the use of the PERF is warranted. Cautious use is based on the observable threatening nature of the device and its application in the context of a therapist-client interaction.

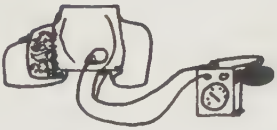
Nevertheless, when appropriate, the PERF can be used in several ways. The client can be trained in the attachment and use of the instrument and do home practice with either a partner or using visual imagery of sexually arousing scenes and individuals. This reduces the threatening situation of the office and allows a personal exploration of sexual themes. It is most successfully introduced after the same visualizations have been previously explored with the GSR. In the office, the client is instructed how to attach the penile ring and then applies it in a restroom, returning with the wire and plug coming up over the top of his belt. In more permissible

circumstances, the client might be unemcumbered by clothing. The procedure involves the presentation of sexually stimulating stimuli in the form of slides, audiotape, photographs or guided imagery sequences. The goal in all cases is to determine what events are arousing and to gain better control over the sexual response in the form of the erection.

"In biofeedback, the patient is the treatment."

Single feedback multi-input (EEG, EMG, HR, etc.) (May include screen)

Cardiotachometer-
Digital Heart Rate Fdbk



Electronic Blood Pressure Cuff, light/tone

Pulse Wave Velocity
(may include Heart Rate)

Penile Erection Fdbk
(may include TEMP)

TYPES OF OTHER BIOFEEDBACK INSTRUMENTS

Vaginal Feedback:

Two major techniques and instruments are used in the case of sexual arousal training in the female. Vaginal blood flow using a plethysmograph or a temperature thermistor in the vagina. Since blood flow is related to sexual arousal in females, this procedure is potentially useful, although little substantive work has been done. A second device, the perineometer, measures vaginal floor contraction. It is used for strengthening exercises, especially for women who have had muscles weakened by childbirth. By inserting a conical latex form into the vagina and observing changes in pressure on the dial which is connected by a rubber tube, the user can see when correct muscles are being exercised and how strongly they are contracting. The flexible rubber air chamber is inserted into the vagina and is connected by a tube to a clock-like pressure gauge which measures the strength of each muscular contraction. It is useful feedback for clients with vaginismus (painful intercourse) to learn how to contract and relax the vaginal muscles. In addition, it is helpful for women who would like to gain more control over those muscles for greater satisfaction and pleasuring of their partner in intercourse.

Video Tape Feedback (VTR):

Closed circuit television and video recording are important feedback devices in that they allow visual feedback of facial and bodily information. Many clients have not had the opportunity to view themselves either at the moment or in a delayed mode. Looking into a mirror does not yield the same kind of information as seeing oneself on the television screen, which has more the quality of "looking at yourself" rather than just "seeing yourself". In addition, the VTR allows instant replay of an event. An example of the feedback use of VTR is in the treatment of tics. The patient with a facial tic can view himself on the screen to get a clear understanding of the facial movements involved in the behavior. The therapist and patient can replay the tic episode and view the activity; which means that eyeblinks and side glances which were not observable previously can be seen. The movements, pattern and feelings about them can be discussed in the process.

The EMG or other instrument can be used in conjunction with the VTR. This is best done by framing both the face (or significant part of the body) and the instrument meter on the video screen. Thus, the patient can relate the movement (spasm activity) with the microvoltage change, greatly speeding the learning process. Other treatments which benefit from multimodal use of VTR and biofeedback instrumentation are neuromuscular re-education issues, such as : paraplegia; stroke; low back syndrome; torticollis; and Bell's Palsy.

The VTR is used motivationally to demonstrate progress through various sessions and compare performance at the beginning and conclusion of treatment.

Certain sessions or segments representing breakthroughs can be stored and reviewed. Finally, the videotapes may be used , with client's permission, for professional training seminars and staff education. Difficult issues which arise can be reviewed and discussed , or a consultatant brought in to comment on a taped session.

Instruments from Common Devices:

Although sophisticated and expensive office and portable biofeedback instruments are now readily available, there are occasions in which simpler and inexpensive devices can be used. These devices may be common objects available from scientific supply houses or certain stores.

A readily available and useful device is the household thermometer. It should be a common room thermometer: small, lightweight, with the bulb exposed. An oral or rectal "fever" thermometer will not suffice, as the temperature range is too limited. There are very small thermometers sold in some supply houses in lots of 100 (or less), and are usually made for commerical gifts , desk calendars, etc. These are ideal for this application in that they are light, small and cost a few cents each. The bulb is taped to the finger tip , and after a considerable delay for adjustment, will give a finger temperature indication. The person can tape the small thermometer prior to doing the relaxation exercise and note the pre- and post-relaxation temperature. While it is not sensitive enough to effectively begin training, it is particularly useful for taking finger temperatures during the course of the day, before and after relaxation training exercises, and after learning has progressed to the point of being able to do hand warming of several degrees in a few minutes.

The mood-ring is a novelty item sold in some stores (often for less than $15). with the claim that the colors of the stone reveal one's emotional "mood" state. The lucite "stone" is backed with liquid crystal which is responsive to temperature by changing color. The changes are typically from black (coldest) to brown, green ,light blue, and deep blue (warmest). The temperature range may be as much as 20 degrees from approximately 75-95 degrees. Provided that the person understands that environmental and other factors (cold water, cool metal, etc.) affect the temperature greatly, it is a good indication of relative hand temperature on a more or less continuous basis. The colors of the ring can be related to stress events, interactions and other emotional responses during the day. As the person begins to recognize the times and situations in which peripheral vasoconstriction occurs, he becomes more aware of the stressors in his life. Other liquid crystal products are available. Liquid crystal solution can be painted on any surface and will change color in relation to range of temperatures.

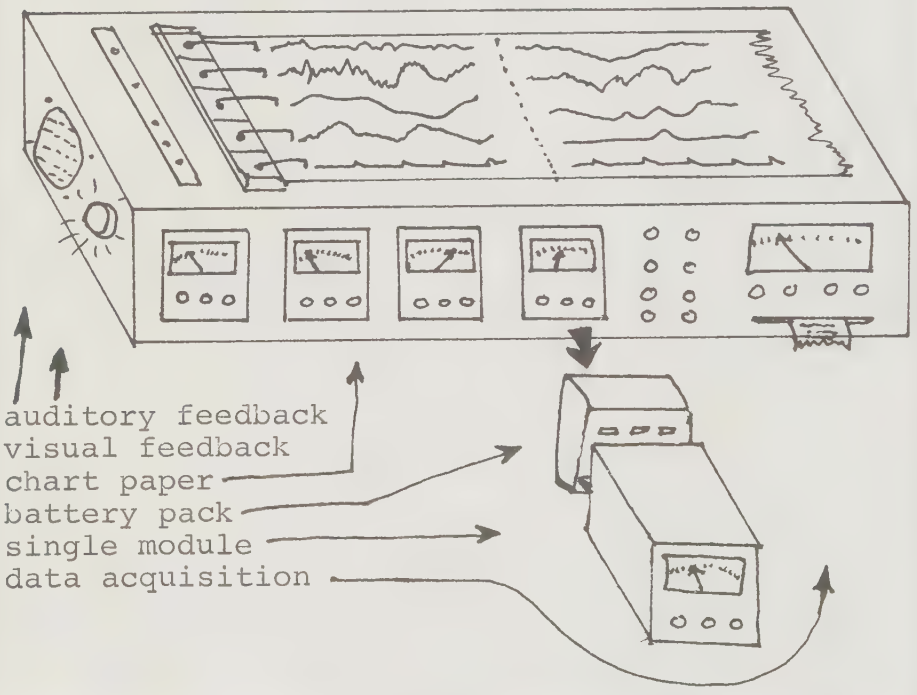
The common bathroom scale has been described as a biofeedback device for teaching dynamic balance, the shifting of weight and balance in walking for gait training, and the development of a sense of balance with visual feedback (Peper, 1976).

The mirror , although considerably less effective than video-tape recording , is helpful in providing visual feedback of postural, facial, and movement information. It is especially useful in home practice. An example is found in the treatment of hair-pulling compulsion in which practice sessions of volitional hair pulling behavior were prescribed in a negative practice protocol.

AN IDEAL CLINICAL INSTRUMENT

FEATURES:

1) INTERCHANGEABLE MODULES PLUG INTO MASTER UNIT, CAN BE USED INDEPENDENTLY AS TRAINER.
2) RECHARGEABLE BATTERY PACK IS ACCEPTED BY THE PINS WHICH PLUG INTO THE MASTER UNIT(AC).
3) BUILT-IN CHART RECORDER (OR VIDEO SCREEN) AND DATA PRINTER FOR BOTH CLINICAL CHARTS AND RESEARCH. THE GRID PAPER (1 HR AVERAGES ON 8½x11 SHEETS) CAN BE TORN OFF EACH SESSION FOR CLIENT'S RECORD.
4) COMPACT (24x6x10) WITH BUILT-IN METER, AUDITORY, AND VISUAL FEEDBACK.



CHAPTER III

CLINICAL PROCEDURES

Orientation
- Purpose
- Cognitive Restructuring
- Misplaced Efforts

Models of Treatment Approach
- One to One Approach
- Evaluation Approach
- Alternating Rooms Approach
- Therapist-Technician Approach
- Prescription Approach
- Instructional Approach
- Standardized Approach
- Automated Approach
- Eclectic Approach

Treatment Overview

Therapist's Handling of Initial Session

Intake Procedures
- Referrals
- Phone Screening
- Initial Visit
- History Outline
- Psychophysiological Profile
- Choice of Instruments
- Recordkeeping
- Home Practice Record Cards
- Weekly summaries and Follow-up
- Generalization of Relaxation

Group Biofeedback

Precautions and Contraindications
- Concurrent Medication
- Age
- Improper Training
- Psychosis
- Cardiac Problems
- Motivation
- Insufficient Arousal

Additional Clinical Comments
- Defocusing the Symptom
- Relationship Placement of Sensors
- Use of Tapes
- Use of Medication
- Average Number of Sessions
- Sessions per Week

While Chapter II discussed instruments and technical issues, and Chapter IV will discuss syndromes and their treatment, this Chapter focuses on orientation of approach to the patient. The introduction of the technique, wording, analogies for generalization, facilitation and application in everyday life are described. The steps of intake from first contact and contract setting through conclusion of treatment or training are outlined.

"Biofeedback learning must generalize outside of the office situation in order to be effectively helpful in day to day life."

Purpose of Biofeedback Training:

The purpose of applying biofeedback instruments is not particularly to produce any state but instead to facilitate self-awareness and control. For example, in the case of EEG, the goal is not to produce an "Alpha zombie" who is "spaced out" but instead to help that person learn to become aware of and control the level of awareness and ability to relax. In addition, it should be pointed out that even when the instruments do nothing physiologically specific to the individual, they still affect the person's understanding of the relationship with their body and ways to deal with it that they may not otherwise learn.

For example, in the pain cycle, what typically happens is that there is a pain which the person subjectively feels. They brace to the pain, thus exacerbating it and producing other painful contractions of the muscles near the original site. He then becomes anxious and worried that they cannot deal with the pain and thus, even if the original pain is ever alleviated, the pain cycle which has begun may continue. With the instruments, the person observes what it means to "let go" and perhaps yield into the pain which is difficult to explain verbally. Thus, the person learns to interrupt the vicious pain cycle.

Cognitive Restructuring:

This term refers to the groundwork that is laid before training is begun and which may continue throughout the treatment. I feel that it is an absolute necessity for effective generalization and integration into the person's total life. Phrases are used that adequately reflect to the client the purpose and effect of biofeedback. Examples of real-life stress are given, parallels to the processes involved in "letting go" are described and the concepts are demonstrated.

In this very important section, I hope to cover concepts and statements about biofeedback which may well be as important as the biofeedback training process itself and might be seen as a part and parcel of the process. Both the belief of the therapist as well as that of the client is critical in determining the effectiveness and progress of biofeedback. Thus, the therapist needs to have a sense of philosophy and the goal orientation in which he works and needs to convey to the client certain concepts which makes the process understandable, especially in relationship to the issues for which he sought treatment. These initial understandings or statements which I will refer to as cognitive restructuring are usually accomplished very early in therapy and repeated or returned to periodically in the whole process.

The goal of biofeedback is to do away with the machines. They are to be used while they are useful in facilitating that person's understanding of their own body and control until certain internal loops can be achieved. The machine is gradually replaced by a proprioceptive mechanism which now allows the individual the kind of

control that he formerly had only with the instruments. The word for this might well be mastery and the underlining philosophy is essentially one in which the therapist and his instruments are "put out of business." Certain statements and analogies are important to patients to understand both the mind-body interaction in the process of biofeedback. The following analogies have been particularly useful".

The Urination Analogy: Most people can relate to the process of urination and can understand that it has to do with the process of letting go. What it takes to urinate is to let go in a specific way of which the person has very little conscious awareness. This letting go does not just occur in sleep but instead is a volitional decision to let go. Through this analogy, the patient can be made aware of the concept of not losing control but of relaxing.

Much of what is done in the first few sessions, certainly in the first session, is a cognitive restructuring, both in the terms of expectations and in the terms of the person's orientation and philosophy about their own body and mind. Most people make a tremendous separation. They have separated their symptoms. People often know what stress is, but do not apply it to them. We often use an instrument at the outset, especially the GSR, to show the person that their thoughts are at their fingertips. After you clap your hands and the GSR explodes with a tremendous rise in conductance you allow them to drift back down. If they have difficulty, it still allows them to see that it relates to something that they actually do. Then ask them to think about something upsetting and when they've got it, just have them

raise their finger to let you know. They will immediately see that a thought will produce a massive shift in the GSR. When you have upsetting thoughts, worries, phobias, etc., your entire body as a whole is reacting with your mind. That is, you are reacting as one entity, unit, body, mind. Your feelings are reflected in your functioning and that becomes part of the treatment.

"If nothing else, the instruments teach the individual what it means to "let go." Something which is virtually impossible to explain."

Misplaced Efforts:

The concept of dysponesis, a term which George Whatmore (1974) coined, means essentially "misplaced efforts." An example of this might be the casual awareness that one's jaw hurts after clipping nails, only to discover upon reflection that with each clip of the nail clipper, we had clamped down or clenched the jaw as if to bite. While this is not a very severe symptom, it serves to illustrate that there are often unnecessary movements and tensions which use energy, which may cause pain and of which we are not aware. When these misplaced efforts occur frequently or chronically, the person may have chronic pains or tensions and may not even be aware of the genesis.

The second example of misplaced efforts might be seen in very common everyday activities such as writing, driving and sitting. They all can have, associated with them, certain conditioned tensions or bad habit patterns which are examples of misplaced efforts. When one writes in a very relaxed and easy manner, there is no cramping of the hands and the person can write comfortably for a long period of time. However, when the pen is clenched tightly in the hand, the arm held rigidly in full muscle tension, the back hunched, the neck stretched down, and the teeth clamped together, then we see a person who becomes tired quite quickly and feels exhausted even after taking a short examination or taking notes at a lecture. These tensions are seen as unnecessary to the activity itself and are, in fact, counterproductive.

Models of Treatment Approach

I. The One to One Approach (or "Psychotherapy" Model): The primary therapist and client are together for the full session. Advantages: Good rapport and interaction can be developed, the therapist is directly involved in all aspects of client's progress, continuity of treatment from intake through termination. Most complete and lasting treatment seems to result from this model in our clinical experience. Disadvantages: High cost, uses highly trained therapist time even during the portions of treatment that involve direct training.

II. Evaluation Approach or ("Social Work" Model): One therapist does evaluation (history, psychophysiological profile, and symptom clarification) then client is seen by a therapist or technician who develops the treatment plan and does the training. Advantages: Client can be seen for treatment by most appropriate therapist. If the problem requires straightforward training then a technician may be used. If medical or psychological issues are relevant an experienced therapist is used. An efficient method especially if large number of therapists and technicians were available. Disadvantages: Duplication of information gathering and initial relationship, client may be unsure as to which person is the therapist. Potential confusion over goals of treatment and the contract set.

III. Alternating Rooms Approach (or "Dental" Model): A single therapist may see two or more clients each in separate offices, consecutively. Advantages: By setting hourly appointments at each half hour, the therapist can talk with the client for half the hour and then allow the client to train on the instruments for the other half, during which he can be talking with the next client. This

model makes it possible to see two clients during each hour. It removes the therapist from having to "sit with" the client during training thus reducing the costs.
Disadvantages: Timing and scheduling become extremely difficult with little flexibility in issues which need to be continued or examined in more depth. The client may feel abandoned or need guidance. If an assistant is involved during the training time, the client may still experience abrupt changes instead of a smooth flow to the treatment and relationship.

IV. Therapist-Technician Approach (or "Nurse" Model): The client works with two persons, one having primary responsibility for the treatment program decisions and evaluation and the other serving as technician handling the more routine work of electrode placement, instrument set up, facilitation in training, and scheduling.
Advantages: This model is one which will be most familiar in a traditional physician's medical practice, and has the benefit of conserving the more expensive therapist's time. It is a model which differentially utilizes each therapist's particular skill and training.
Disadvantages: It requires the cost of the services of two therapists for each patient, although some overlap of patients is possible. The cost and potential diffusions of responsibility is increased somewhat in that two individuals are involved jointly in the treatment process.

V. Prescription Approach (or "Physical Therapist" Model): In this model, the evaluation and recommendations for treatment "prescription" is carried out by one therapist (practitioner) and the actual treatment/training is conducted by an assistant or perhaps other therapist.

Advantages: Cost is decreased in that appropriate and specific use is made of expensive time. The technician may conduct the training perhaps with a provision for reevaluation after a specific time period or number of sessions (e.g., this is sometimes done effectively by having an automatic re-evaluation if the client has not progressed in three training sessions).
Disadvantages: It requires that a comprehensive treatment recommendation be developed with the first session or so. The client has some confusion as to who the therapist is, and with whom to discuss certain issues. This is intensified if each therapist unwittingly abdicates decision-making functions to the other. Communication must be very good between the practitioners.

VI. Instructional Approach (or "Educational" Model): The therapist sees him or herself as a teacher in order to instruct the client/"student" in the procedures and use of the instruments for personal use.
Advantages: It maximizes the facilitator role in that it conveys to the client the message that he will be ultimately responsible for his own training and progress. The expense and time of "treatment" may be reduced if the client is able to purchase his own instrument for home use and continue training, possibly with periodic trouble-shooting or follow-up appointments.
Disadvantages: The client is apt to flounder, misinterpret training meaning or effects, or discontinue training without guidance, facilitation, and motivation by the therapist. As has been stated previously, the therapist/client relationship is a powerful ingredient in the total biofeedback process. Equipment use (rather than collecting dust on the shelf) and misuse as well as maintenance provide additional problems which are dealt with in an office setting. Some conditions lend

themselves to this approach more than others. (More medically involved conditions require closer supervision.)

VII. Standardized Approach ("Experimental" Model) Standardized procedures in the form of flow-charts or guidelines are used which each client goes through. Steps of treatment from evaluation through termination are outlined and prescribed as in a cookbook.
Advantages: A flow diagram would theoretically allow anyone to "administer" the treatment without having to have the extensive training required for independent decision making. It is best suited for research because of its testable and consistent nature. Therefore, it is less costly, more systematic and lends itself to outcome evaluation.
Disadvantages: Because of individual differences in needs of clients and their conditions, the procedure most often must be tailored to fit these particular needs. One pre-set approach must often be arbitrary to fit every case. While ideal for research, the approach is arbitrary and generally unsuited for clinical work.

VIII Automated Approach (or "Computer" Approach) Carrying the previous approach a step further, the training can be directed from a central control console from which a single operator/therapist can monitor and shape the progress of several client/trainees. It is possible following initial evaluation and goal setting to have a program of training which is programmed into a computer which uses predetermined criteria and shaping curves.
Advantages: This model provides the ultimate in instrumentation and mechanized efficiency, lowest training costs and maximum utilization of equipment, space and personnel.

Disadvantages: The initial expense of instrumentation, interfacing and computer is high. Very little human contact and personal variability is possible. It is a real question as to how broadly this approach can be applied. We have rarely encountered cases in which personal interaction and individually tailored programs are not needed.

IX. The Eclectic Approach (or "Combined" Model)
This model utilizes some of the better points of several approaches, amalgamating them into one procedure or sequential procedures.
Advantages: While an approach may fit some individuals, conditions and needs of training better than others and there may be shifts of needs during the course of treatment.
Disadvantages: Some approaches are incompatible with others, or produce a confusing shift or focus for the client. It is difficult to apply and schedule different approaches in a single treatment setting and/or facility.

Conclusions

Since each setting, therapist and client is unique, it is impossible to predetermine which of these models will be the correct or most effective one. However, having attempted to use each approach to some extent in a multidisciplinary setting, some evaluative comments can be made as to the relative merits and conclusions drawn.

In general, the first, or one-to-one model has been preferred by our therapists when the whole range of approaches are available. It is most convenient to schedule, offers maximum continuity and maintains warm, human relationships.

Disappointingly, we have found that the somewhat less expensive approaches which utilize more systematic and standardized procedures or greater use of assistant/technician time suffer from inflexibility, greater opportunity for confusion and incomplete therapy, and inappropriate application.

While this may not at all be the case in other settings, we would suggest approach I., especially at the outset, as the therapist develops a thorough understanding of all the intricacies of the biofeedback work. Other approaches may be introduced on a trial basis and their relative effectiveness evaluated case by case.

This statement may be received with some surprise by those who envisioned the practice of biofeedback to be one in which hourly contact could be reduced and greater numbers of clients seen. In our experience this is not readily achieved and the practice of biofeedback requires as much skill, attention to detail, client contact time and individualization of treatment as other health care and growth approaches (e.g. psychotherapy, physical therapy). What is decreased, on the other hand, is the length of treatment; biofeedback being a tool which greater facilitates the brief treatment of certain psychophysiological symptoms.(Fuller, 1976b)

Treatment Overview:

Although treatment may differ in patient readiness, symptom intensity, speed of learning deep relaxation, etc., the following prototype schedule is a representative course:

Session I - History, development of rapport, cognitive restructuring and clarification of biofeedback, initial baselines and response through psychophysiological profile, setting of contract including fee and discussion of therapeutic plan.

Sessions II to N-I - Evaluation of week's progress and activity, review of home practice, symptom intensity and occurrence, medication use, if any, reinforcement of relaxation skills, including deepening and enhancing, biofeedback training on most appropriate instrument or multimodal feedback which integrates several instruments.

Session N - Overview of treatment, effects and limitations, check of internalization of biofeedback learning, evaluation of generalization to outside life, recommendations for future including awareness of symptom and how to continue progress on one's own. The closing research information, follow-up arrangements.

STEPS IN BIOFEEDBACK TREATMENT

INTAKE
- EVALUATION
- HISTORY
- BASELINES-PSYPHY PROFILE
- RELAXATION TRAINING
- CONTRACT-GOAL SETTING

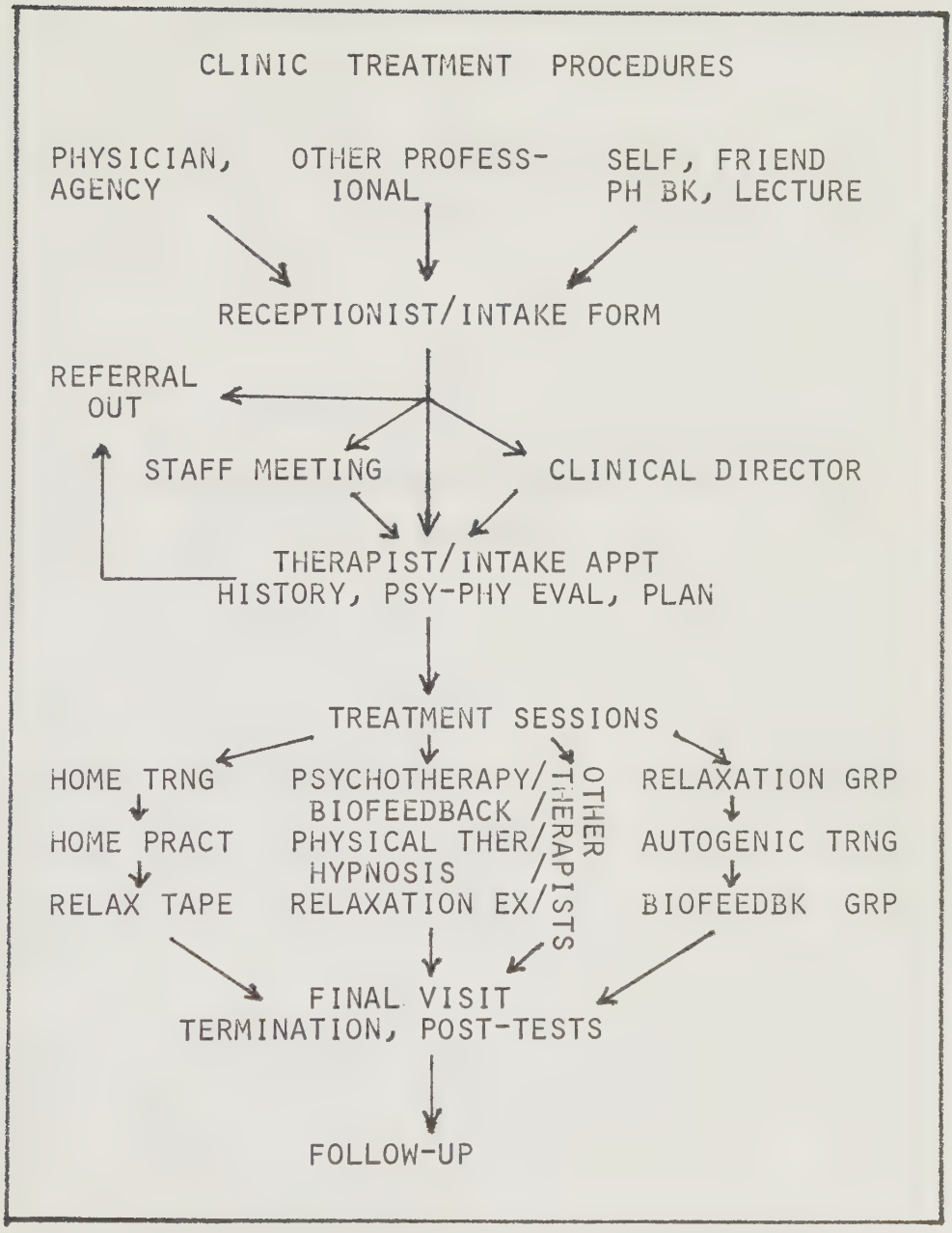
TREATMENT SESSIONS
- HOME PRACTICE/TRAINING/TAPES
- RELAXATION/AUTOGENIC TRNG GRPS
- BIOFEEDBACK/PSYCHOTHERAPY

TERMINATION
- POST-TESTS/PROFILE
- FUTURE GOALS

FOLLOW-UP
- REINFORCEMENT OF PROGRESS
- REFRESHER SESSION

Therapist's Handling of Initial Sessions:

The therapists are responsible for setting their own contracts, for developing their own history and for using their own style and personality and their treatment. If this were a research project totally and not a clinical orientation, everything would be specified. There are individual differences. The most common standard procedure is that the patient is told about the instruments one at a time as they are being hooked up. They are asked beforehand about their feelings about instrumentation and any previous experience with instrumentation. They are told that the electrodes are sensors and that they are placed on the surface of the skin and that they do not shock and that they do not make any input and voltage, that the instruments themselves are battery operated. They are not harmful and they simply measure the change in the body. Clients are asked about anything they know about the relationship of stress and the relationship of physiological changes and measures. Get some idea of how comfortable, oriented and how much cognitive knowledge they have. They may say," I have read an article, yes, I know what that is, it's all about Alpha waves and EEG." The therapist then might have to educate the person about EMG as well as other instruments, by providing basic information and issues about muscle tension and how and what is being measured. This can be done in a casual way while you are attaching the electrodes to the proper sites.


CLINIC TREATMENT PROCEDURES
PHYSICIAN, AGENCY
OTHER PROFESS-IONAL
SELF, FRIEND PH BK, LECTURE
RECEPTIONIST/INTAKE FORM
REFERRAL OUT
STAFF MEETING
CLINICAL DIRECTOR
THERAPIST/INTAKE APPT HISTORY, PSY-PHY EVAL, PLAN
TREATMENT SESSIONS
HOME TRNG
HOME PRACT
RELAX TAPE
PSYCHOTHERAPY/ BIOFEEDBACK / PHYSICAL THER/ HYPNOSIS / RELAXATION EX/
OTHER THERAPISTS
RELAXATION GRP
AUTOGENIC TRNG
BIOFEEDBK GRP
FINAL VISIT TERMINATION, POST-TESTS
FOLLOW-UP

Intake Procedures:

Referrals:
The following are models from which you might benefit from our experiences. The Institute has operated as a private psychological corporation which is different from hospital affiliation or independent practice. About half of the patients are referred by physicians or other professionals. The other half are self-referred; coming from recommendations of former patients, through a class or programs, by friends who have heard about biofeedback or by looking it up in the phone book. As patients get effective results from their experience at the Insitute, we find that the number of others they refer is increasing.

Phone Screening:
The phone call is usually taken by the Administrative Assistant who is quite experienced in doing screening on the phone. (She will make appropriate referrals, e.g., the person who calls in drunk and in a panic.) She very carefully and competently goes through the definition of biofeedback to a person who has a misunderstanding of what it is and then asks them if they need information that we can send to them to look over. More than 50% of her time is spent giving information to people who call. While time consuming, it does allow public information about biofeedback. If the person has a symptom or request that we might be able to handle at the Institute, a duplicate intake record is made and given to the appropriate therapist, who is the one best able to deal with the particular issue the person
schedule. If it is not clear to the intake receptionist, the intake will be staffed on the

weekly staff meetings. That intake will be discussed, and a decision made about who might best deal with the problem.

Initial Visit:
The first visit lasts 1½ hour. Typically, the first half-hour is spent filling out intake information forms , psychological evaluations, and clinical research forms.

The clinical research information is used in our ongoing research project in which we obtain information about the progress and efficency of the treatment provided. It is a time-consuming project, and is funded solely from clinical income. The questions asked are brief, and the format allows the information to be transferred to computer cards on a regular basis.

The primary psychological evaluations used include a short form of the MMPI (Mini-mult), the Rotter Internal-External Locus of Control scale, and the Holmes-Rahe Life Change Inventory. The Mini-mult MMPI is a 78-item short form of the MMPI, which correlates about.82 with the full MMPI, i.e. 64% of the variance is accounted for by this version. We have made modifications on both the Rotter and Holmes-Rahe scales (e.g. on Holmes-Rahe, we use past-12 months and future-12 months in order to determine the patient's anticipations).

After these forms are completed, the therapist greets the patient and they go into the office. Although subject to individual differences, the next half-hour is typically used to obtain a history and focused evaluation of the presenting problem. During the remainder of the session

HISTORY OUTLINE

TOPICS

ONSET AND DEVELOPMENT OF SYMPTOM/CONDITIONS ASSOCIATED WITH ITS OCCURRENCE

GENERAL MEDICAL HISTORY

SEXUAL AND MENSTRUAL(DIFFICULTIES, ANXIETIES, PAIN, EFFECT ON MOODS,ETC)

FAMILY/ HOUSEHOLD / SIGNIFICANT OTHERS

OCCUPATIONAL HISTORY

FREE TIME (HOBBIES, EVENINGS, EXERCISE, ETC)

BRIEF SELF-DESCRIPTION

CHEMICAL AND FOOD INTAKE

ILLUSTRATIVE QUESTIONS

HOW AND WHEN DID THE CLIENT FIRST BEGIN TO NOTICE THE SYMPTOMS? WHO ELSE NOTICED?

WHAT STRESSES WERE GOING ON AT THE TIME THE PROBLEM FIRST BEGAN?

WHAT DID THE CLIENT DO TO DEAL WITH THE PROBLEM? HOW DID THESE INTERVENTIONS WORK?

WHAT BRINGS THE CLIENT TO THIS FORM OF TREATMENT NOW? IS THE PROBLEM GETTING WORSE; HAS IT JUST RETURNED; OR IS IT THE SAME AS ALWAYS?

a psychophysiological profile is obtained. This is done with three instruments or more: EMG (always); TEMP and/or GSR; and heart-rate, blood pressure, or EEG (depending on the issues involved). Baselines are obtained. These are resting baselines, as the person has been sitting in the office for at least 30 minutes. One of the biggest criticisms of many studies in biofeedback is the inadequate pre-baseline period, since there is a tremendous shift in physiological patterns in just resting, that has little to do with training per se. Thus, a baseline should be obtained after a reasonable resting period.

Psychophysiological Profile:
The baselines are recorded on a multi-channel recorder so that the measurements are taken over a time period. The following procedure is used:

1.Five-minute rest period, where the client sits comfortably, not doing anything in particular.
2. Five-minute period, where the client is asked to relax in whatever way they have found to be best for them , while sitting in a chair.
3. Ten-minute guided relaxation procedure.
4. Ten-minute stressor and recovery period, where the therapist may make a sudden hand-clap or pinch, or ask the client to think of something upsetting, or something which they have found to be frustrating, frightening or angering recently.

During the baseline measurements the therapist observes: how the client relaxed on their own; how they relaxed with facilitation of relaxation procedure; what variables changed; what patterns emerged. Note that the psychophysiological profile is a part of the diagnositic evaluation, not a research study, so that there are considerable confounding variables in the clinical situation.

Choice of Instrument:

First determination is made on the basis of the instrument with which the person has the most success. It is particularly important that the patient get reinforcement and positive results at the outset.

Other criteria of instrument choice include the most related system to the symptom. In migraine treatment, one would probably not begin directly with temperature as that is often difficult for the person to relate to, and has a high frustration and potential failure factor. Instead, it is preferable to begin with relaxation training and EMG feedback while monitoring temperature changes. Frequently it occurs that when the person begins to do temperature training, they have decreases in hand temperature even though they had a raise when doing EMG training. Our experience has indicated the most clinically useful sequence is:

a. The instrument with which the patient shows most possibility of control and reinforcement.

b. The one shown by the psychophysiological profile to be the most responsive.

c. Finally, the one indicated in the research.

Recordkeeping (Use of home practice cards and logs)

If clients have headaches, for example, and are asked how often they have headaches, they may well respond with "everyday", "all the time", etc. When records are kept one may find a pattern. There are often days when they are headache-free; some people only have headaches on weekends, when they "let down"; others only in the mornings; or others mainly around lunch-time. The pattern can give valuable information as to the stressors inv ved (e.g. related to home, work, food, or vacations.).

Home Practice Record Cards:
These cards provide spaces where the client enters information on a daily basis on each of several variables, including: when they did the relaxation exercises or other home practice; the severity and frequency of the symptom; use of medication; and comments.

These records are invaluable , no matter how adequately session records are kept, in getting a more complete view of treatment progress. Patient verbal-reports can be compared to these daily logs. Subjective perceptions of symptom occurrence may not match the logs. For example, some patients will remark that they do not see much difference in their symptom occurrence, but change is very clear on the logs; others will say,"I have been helped a great deal", "Thank you", etc. but there is no change in the symptom or medication use. More than inaccurate reporting, there may be more psychological issues involved. This method will help separate these inconsistencies. Additionally, the logs provide information of medication usage and decreases or increases thereof.

SUGGESTIONS TO PROMOTE GENERALIZATION OF RELAXATION TO DAILY LIFE:

1) MINI RELAXATIONS MANY TIMES EACH DAY; WHILE TALKING ON THE PHONE, WAITING IN LINE, ETC.

2) PAYING ATTENTION TO BREATHING PATTERNS AND BREATH HOLDING.

3) USING A "BLUE DOT" ON THE WATCH, CAR MIRROR, TELEPHONE DIAL AS A CUE TO RELAX AND REMIND ONESELF TO UNHURRY.

4) INTERNAL CUE WORDS SUCH AS "CALM" OR "QUIET INSIDE" AS RELAXATION STIMULI.

5) DYMO LABEL REMINDER ON DESK, PEN, OR KITCHEN TABLE,ETC, TO RELAX AND SLOW DOWN. (E.G., WHAT'S THE RUSH?)

6) RECORD KEEPING OR LOG OF TENSION SIGNS AND EVENTS WHICH PRECIPITATE SYMPTOMS.

7) MOOD RING TO OBSERVE VASOCONSTRICTION, OR PUTTING HAND TO FACE TO CHECK TEMP.

8) OBSERVATION OF TEETH CLENCHING, TIGHT JAW, OR EYE STRAIN. NOTICING FOREHEAD WRINKLING, NECK TIGHTNESS, OR ANAL CONTRACTIONS. PUT AN "AHH" IN EACH EXHALE FOR A FEW MOMENTS AS THE TIGHT AREA IS LET GO. BREATHE INTO THE AREA.

Weekly Summaries and Follow-up:
Coordinated with our clinical research program are weekly summaries completed by the client at the session, and follow-up questionnaires sent at three (3) and six (6) month intervals. Analysis of research information compiled over the past three years indicates the usefulness of global assessment scales. (see Research Chapter).

Group Biofeedback :

There are three different forms of group feedback:

1. Putting patients with similar types of problems into the same group to discuss, confront, and support each other. (E.G. Relaxation groups for anxious patients; Gastrointestinal groups; Headache groups). While it may seem that these patients are similar and may support each others' symptoms, they are also best able to see through the games and resistances to change. The group's members themselves become one of the therapist's strongest allies. Frequently members will try to outdo one another's stories; other members will "call" them on it. This method does not use instruments per se; instead, the individual training is done outside the group situation. Other factors favoring the group arrangement include: cost effectiveness; structuring cognitive understanding and explanations; mutual support and sharing of experiences.

2. Relaxation groups: This requires that the therapist do relaxation procedures (e.g. progressive relaxation or Autogenic relaxation), a single time for the benefit of several clients, rather than individually. It is less expensive for the client, and members can reinforce each others' successes in relaxation and letting go. At the same time, some or all group members can be monitored on bio-

feedback instruments. TEMP is particularly useful because it may indicate a resistant patient who reports being very relaxed, and whose EMG shows low muscle tension.

3. True "Group Biofeedback" is rarely done. Such possibilities as having all members hold hands in order to get "group GSR" or "group EMG" levels have not yet been seen as effective treatment techniques. However, for space, equipment, or personnel reasons, clients may do individual training in a group setting.

> The therapist or trainer is part of the biofeedback loop.

Precautions and Contraindications:

The therapist should be aware of potential problems arising in the course of biofeedback training as well as contraindications to biofeedback. The following represent some of these areas:

Concurrent medication: Patients on medication at the time of working with biofeedback must be followed closely by a physician. Problems arise when the patient is prematurely withdrawn from the medication, is led to believe that the medication is no longer necessary since he is in biofeedback training or has a reduction of the requirement of the medication because of changes resulting from the biofeedback training. These possibilities may especially arise in the following areas: hypertension, hypotension, inadequate daily medication coverage, diabetes(insulin coma due to reduced need for insulin injections)and epilepsy (increase in seizure activity).

Age: The elderly are frequently on various medications and are particularly prone to hypotension. Patients over 65 should be seen with caution, especially for blood pressure biofeedback as there can be a decrease in cortical flow.

Improper Training: The use of noneffective training procedure may result in some lessening of the patient's finances, but an inappropriate one could have detrimental effects. Low frequency EEG training may potentiate epileptiform activity. Unilateral masseter EMG training for bruxism may result in jaw dislocation. Use of improper muscles as target electrode sites in torticollis may result in exacerbation of the disorder and greater imbalance.

Psychosis: The prevalent experience is that in general, schizophrenics show little learning in biofeedback and the use of the instruments may be woven into a delusional framework of control of the mind. Patients who have experienced shock therapy are especially frightened by even the sight of the machines.

Cardiac Problems: Premature ventricular contractions and other cardiac arrhythmias as well as tachycardia and bradycardia are perhaps best seen in the in-patient setting such as a coronary care unit in which life support equipment and personnel are readily available. In fact, since much of the heart rate and blood pressure instrumentation is most likely readily available and can be modified for biofeedback training, and since the patient under observation may have the "leisure" to do short periods of training, this setting may be ideal for cardiac biofeedback. The autogenic training literature has several references to the precautions to be taken with cardiovascular problems. (See Luthe, 1969).

Motivation: Most successful outcomes in biofeedback appear to occur when the patient is intelligent and motivated. The reason and generalization to daily life are important factors in the effectiveness of treatment and avoidance of potential misuse.

Insufficient Arousal/Attentiveness: Following biofeedback training or deep relaxation, some attention should be paid to the clients attaining a full state of awareness of the environment before leaving the office. While this is rarely a problem, comments such as "I feel tired and sleepy" or "spaced out" should not be dismissed and appropriate guidance or period of readjustment should be fostered.

Additional Clinical Comments:

Defocusing the Symptom:
In discussing the symptom with the client use of words which refer to areas of the body, rather than the symptom itself, may help the client reframe his or her focus away from the symptom and to his body. For example, headache patients often feel that if they don't have a headache, then there is "nothing up there". Using the word "head" rather than "headache" in talking about the problem will help reframe their focus. The therapist might ask, "How was your head this week?". This restructuring focuses on a bodily area which is part of them (the head), instead of simply on a problem (headache).

Relationship Placement of Sensors:
It may be necessary to place electrodes not only at the site of major concern , but also at another site in order to show the patient that a relationship between the sites exists. For example, placing electrodes on the frontalis muscles of a patient who complains only of low-back pain (in addition to sensors on the low-back muscles), may he helpful in showing more generalized tension and the relationship between the areas.

> "Cognitive restructuring is an essential part of the biofeedback process. Without it, what is done in the office may have little connection with or relevance to the person's daily life and the handling of stress."

Use of Tapes:
It is often preferable to custom-make tapes for the client instead of using commercial relaxation tapes. In this way, the timing, direction and flow of the tape is tailor-made for the particular client and can become their personal tape. It is useful to monitor instruments at the time relaxation is taught to obtain information about the unique way in which that person holds tension in the body. This makes possible a more precise exercise and ,thus, more rapid learning.

To prevent dependency on the tape suggest that the client use it only every other time at first. Later on, the tape is used even less frequently. The tape should be seen as a facilitator and not something that is "producing" the relaxation, (e.g. some clients have said,"That tape you gave me is great, it makes me relax!"). The goal is to form an internal sense of relaxation, thus the tape is merely an aid at the outset to guide the relaxation learning.

Use of Medication:
Medication should be followed very closely with the prescribing physician. We provide no medication at the Institute, but we do work with the patient and the prescribing physician if medication dosage needs to be reduced as treatment progresses.

Average Number of Sessions:
It happens that our average treatment time is nearly 10 sessions (9.6 based on the first 400 clients seen). This figure should be viewed with caution as it includes drop-outs, re-referrals and those who have no symptoms but contact us for personal exploration (a category we selectively accept).

While the question,"How long will it take?" is frequently asked at the phone intake stage, we have felt it best to attempt an answer only after working with the client for a reasonable period.

Sessions Per Week:

While it is a truism to say that the more sessions one has the more rapid the learning, finances and time available result in a more moderate number than optimum. Typically, our patients are seen on a once- or twice-a-week basis. The training is enhanced by home practice, tapes, use of home biofeedback units (on occasion), or short training appointments several times during the first few weeks. The cost and therapist time limitations make daily appointments prohibitive.

> "The two steps in the biofeedback learning process are awareness of body states and voluntary control over these states. A third step involves using these new skills in everyday life."

CHAPTER IV

FACILITATIVE RELAXATION EXERCISES

Purpose of Facilitation

General Principles of Relaxation

Relaxation Models

Relaxation I

Relaxation II

Relaxation III

Mini-Relaxation Exercise

Autogenic Training
- Standard Exercises of Schultz and Luthe.
- Autogenic Training Phrases of Green (Menninger Modification).

Imagery / Visualization Devices
- Simple Visualization
- Psychosynthesis Technique
- Psychoimagination Procedure
- Space Exercise (Open Focus)

Relaxation and Hypnosis

This chapter reviews and presents methods of facilitating a relaxation in the process of biofeedback. They are meant to compliment the biofeedback training procedures discussed in the next chapter. Depending on the therapist's style and intent, one or a combination of these techniques can be taught the client. The exercises are usually taught at the beginning of treatment as a general procedure and sometimes repeated during biofeedback training or at later sessions. The client is urged to practice these exercises at home or other locations during the intervening week so that he might improve his ability (skill).

> Currently, biofeedback techniques are used in combination with other methods and techniques.

The following principles are suggestions for more effective relaxation training and may be applied to all forms of relaxation including those exercises discussed in this chapter.

1) Pay special attention to the use of words. Use "allow...," "let go of...," "Smooth out...," which promote self control and a "letting-go" philosophy; rather than "make...," "try to...," "produce a..." Avoid effort words and focus on the voluntary response rather than the mandatory one.

2) Be aware of the timing. While the person may become able to relax quickly after some practice, at first there should be a slow, rythmic presentation with adequate pauses for integration of the subjective experience. Don't hurry. Flow naturally from one suggestion to the next.

3) Allow for individual variation of interpretation and experience. "Drift on down through the chair" allows for both the perception of floating lightness and of heaviness and, thus, does not contradict what the person might be feeling.

4) Avoid negative connotations and images. "Comfortably heavy and relaxed" is used rather than "heavy as lead" or "let your limbs be dead weight." Not everyone enjoys certain images that may seem pleasant to you such as "lying in the hot sun,"or "soaring in an airplane" or "adrift in a large void." Ask the client whether a particular image is pleasant in advance or after training.

5) Be aware of signs of tension and relaxation. Coughs, squirming, eye twitching, irregular breathing and muscular holdings are frequent clear signs to alter technique, to inquire about the difficulty or pace the exercise differently. The therapist can develop particular skill in observing the effectiveness of various phrases for the reduction of particular muscle groups for a particular client.

6) Get feedback at the end of the session, discussing the feelings, reactions and resistances that came up during it. The process can be changed accordingly. Point out ways in which self-relaxation is usable in daily life such as at the dentist or when riding the bus. "Was there any area that didn't relax as deeply as it could?"

7) While it is normal to tune out the therapist's voice from time to time and not to recall parts of the script, it is best to suggest wakefulness. Falling asleep can be a way of avoiding relaxation by ignoring the process. Mention can be made of the difference between sleep and the relaxed state of consciousness and the suggestion made that the client not do his or her practice when sleepy or tired.

8) Some people experience discomfort, loss of control, unusual sensations or fear of unusual thoughts. Losing feeling of arms or legs, drifting uncontrollably, having to hold on or resist to avoid losing control of urine, thoughts or body parts are possible negative reactions. Reassurance, exploration or caution are all ways of dealing with this depending partly on the therapist's orientation. Assure the person that continued relaxation is a way of gaining control from within. Caution them to proceed at a pace comfortable to them, and help the person view the sensation positively.

9) Remind the person that this is one technique and they should not see it as the only one. With some practice, clients can develop or "create" their own script. They should not see relaxation as "doing it to them," but that they are "doing it for themselves." That with each practice, as with any other skill, they will become better able to relax quickly and deeply.

10) If briefer relaxation exercises are not sufficient with a particular client, move to the alternate tension and relaxation procedures or to autogenic or visualization procedures, as appropriate.

11) Certain times and places are preferred for home practice of relaxation exercises. Suggest not doing the exercises right after awakening nor just before bedtime. It should be done in a comfortable easy chair - not a bed. If they fall asleep during the relaxation exercises, they are not getting the full benefit from it. (Note: Relaxation techniques can be used to facilitate going to sleep once learned in a waking state and then transferred to use just before bedtime.)

12) Use of relaxation exercises during daily activities should be encouraged once the client learns to relax when "doing nothing." For example, a "mini-relaxation" can be done while driving, especially if in a traffic jam, in order to reduce unnecessary tension and to minimize fatigue,while still attending to the task of driving. Other activities include talking on the phone, especially if on "hold," or waiting in line at the movie or bank.

Relaxation Models

The scripts on each of the following pages describe various methods of relaxation training. They are chosen because they seem particularly effective, are brief and represent major models of relaxation training useful for certain clients, situations and therapists. You may want to choose the one that most closely resembles your particular style, the sophistication of the client and for the purpose of the relaxation.

Relaxation I - Smooth, flowing and involving some imagery , this method is particularly useful for clients who need little training, either because they have had previous experience with relaxation, meditation or similar approaches, or they have a relatively low level of muscle tension to reduce. This method: involves no tension instructions; goes directly to the spreading of relaxation; is very brief, taking between 10 and 12 minutes; and has been the most generally useful of all the relaxation methods.

Relaxation II - Tension/relaxation is a very straightforward, non-imagery method especially useful for clients who are less in touch with control of their muscle relaxation and who need to get a "running start" at relaxing their musculature. This method is used: if Relaxation I appeared not to be sufficient; if the person has little discrimination between tension and relaxation states of muscle contraction; or if no lowering occurs between tension and relaxation on EMG so that a greater distinction must be made.

Relaxation III - A longer and more complete form of training which is useful if the time is available to develop a very comprehensive, systematic and thorough technique. It is of value in group relaxation where the timing and content cannot be easily tailored to the progress of the individual and where the different instructions stand a better chance of applying to the individual needs.

Other relaxation scripts are available from numerous other sources. See bibliography.

Mini-relaxations that are meant to be used during daily life. The patient is urged to do these "minis" when waiting in line, talking on the phone, (when on "hold"), etc. They also can be used to the sight of a clock, "blue dot" on the watch or any number of anxiety evoking stimuli.

RELAXATION I

Just find a comfortable chair and make whatever minor adjustments you need to make to allow yourself to be as comfortable and unrestricted as possible and let your mind just drift throughout your body and check that everywhere is loose, relaxed and that there is no restrictive clothing or uncomfortable position to your body. Again, make whatever minor adjustments you need to make now to allow yourself to be in a most comfortable position. Then let your attention just drift to the very top of your head, to your scalp and forehead - smoothing out all the muscles in your scalp and forehead. Just let them go, relax them. Smooth those muscles out and let your scalp rest very comfortably on top of your head. Let that relaxation just flow on over your eyebrows, eyelids, even relaxing the back of your eyes, letting your eyes rest quite comfortably. Continue to let the relaxation flow over your cheeks, lips and chin, letting your whole face become quite comfortably heavy and relaxed. Pay special attention to your jaw,allowing the muscles that hold up your jaw to relax - just let them go. You will notice that your jaw will be tugged down slightly by gravity and as that happens your lips will part slightly.

As you relax your face and jaw, also let go of your tongue, throat and your vocal chords, letting your vocal chords become quite quiet with your tongue resting very comfortably on the floor of your mouth.

Let the relaxation continue to flow down the back of your head, letting go of all the muscles along your neck and down your shoulders. Smooth out all the muscles of your neck and shoulders. You might

even think of them as tiny knotted rope which you untie and let hang loose and limp. Smooth them out and just let them hang loose, limp and relaxed. Continue to relax your shoulders and neck and let that relaxation flow down into your arms, relaxing all the muscles of your upper arm down to your elbows and your forearm, smoothing out those muscles and letting them go. Let go of the muscles around your wrists and hands all the way down to your fingertips, letting your arms become comfortably heavy and relaxed. As your arms become more and more relaxed and heavy, let the blood flow more comfortably into your fingertips and realize as you let go of the tension in your arms and shoulders, the blood flows more comfortably and easily into the fingertips.

As you continue to relax your head and face, your neck and shoulders and your arms, let your attention now drift to the upper back and smooth out all the muscles along your shoulders and upper back. Continue to relax all the way along your spine, down your middle back, smoothing out all the muscles and down into your lower back, letting go all the way down into your waist and buttocks.

Let that relaxation come around the sides of your body, letting go of all the muscles around your rib cage, smoothing them out and letting go. With every breath, allow your chest to become more and more comfortably relaxed. Just observe your breathing with every breath. Just notice the inhalation of the air through your nostrils, down, down into your lungs, filling up the lungs and then exhaling back out again and allow your breathing to be just normal, rhythmic, smooth. With every breath, allow yourself just to float

down into that chair. Let the relaxation spread down to your abdomen, your waist, smoothing out all the muscles in your stomach to become quite relaxed. Just observe it.

Let go of all the muscles around your hips, waist and pelvis, letting your whole pelvic area relax and smooth out. Continue to let that relaxation flow down to your thighs, knees, down to your shins, calves, letting your legs become quite heavy, comfortably heavy and relaxed. Let go of your ankles, heels, feet - even the soles of your feet and toes. As your legs become comfortably heavy, blood flows again more easily to the toes allowing your feet to become comfortably warm.

Your whole body from the very top of your head, all the way down to the ends of your toes is relaxed, peacefully calm, quite quiet inside. With every breath now, allow your body to let go a little bit more. With every exhale, let your body just float on down through the chair, comfortably heavy and relaxed. As you relax more and more and more deeply, remain awake and aware but very relaxed. Relaxation allows the whole system to have a very deep rest while you are awake and aware. Relaxation is different from tiredness. While tiredness is a drain of energy produced by too much tension in the system, relaxation allows you to conserve the energy that was formerly used up by tension through deep relaxation, such as you are experiencing now. The body can get a very deep rest and you can feel refreshed and rejuvenated.

As you practice these techniques of deep progressive relaxation, realize, as with any other skill, you become more and more capable and effective at relaxing more quickly and more

efficiently. So that soon, rather than going through the entire process, muscle by muscle group, the words "calm," "quite quiet" or relaxed" will allow you to achieve the same quality of deep relaxation that you are experiencing now and,with practice, the depth of relaxation can also be increased. Again, allow yourself to be quite conscious and awake but relaxed and quite quiet inside, and when you are ready, become aware of the room and the environment around you and let your eyes open, remaining relaxed, feeling good all over and refreshed as if you have had a very deep rest. When you are ready, just let your eyes open and become aware of the room.

“What is the real effect of telling a person to "relax;" or even yet, what happens when a doctor says "Mr. Smith, you better relax or you'll kill yourself with this blood pressure!" People don't really know what it means to relax!”

"It's time to become an active participant in the reduction of your own stress."

RELAXATION II

(To be done with pauses between tension and relaxation epochs.)

Find a comfortable place to sit down, lie back and relax. (You might have to shut off this tape while you are getting settled and then turn it on again when you are ready .)

I would like to begin by having you learn how to relax your arms. Settle back as comfortably as you can and let yourself relax to the best of your ability. Now as you relax like that, clench your right fist. Just as you clench your fist tighter and tighter, study the tension as you do so. Keep it clenched and feel the tension in your right fist and forearm. Now relax, let the fingers of your right hand become loose and observe the contrast. Now let yourself go and become more relaxed all over. Once more, clench your right hand, clench your fist really tight, hold it and notice the tension again. Now let go, relax. Your fingers straighten out and you notice the difference once more. Now repeat that with your left fist. Clench your fist while the rest of your body relaxes and clench that fist tighter and feel the tension and relax. Again, enjoy the contrast. Repeat that once more. Clench the left fist tight and tense. Now do the opposite of tension. Relax and feel the difference. Continue relaxing like that for a while. Clench both fists tighter and tighter, both fists tense, forearms tense - study the sensation and relax. Straighten out your fingers and feel that relaxation. Continue relaxing your hands, forearms more and more.

Now bend your elbows and tense your biceps, tense

them harder and study the tension you are feeling. Now straighten out your arms and let them relax. Feel the difference again. Once more, tense your biceps. Hold the tension and observe it carefully. Straighten your arms and relax to the best of your ability. Each time, pay close attention to your feelings when you tense up to when you relax. Now straighten your arms in such a way that you feel the most tension in your triceps and muscles along the back of the arms. Stretch your arms and feel the tension and now relax. Put your arms back into a comfortable position. Let the relaxation proceed on its own. The arms should feel comfortably heavy as you allow them to relax. Straighten your arms once more so that you feel the tension in the triceps. Feel that tension and now relax.

Now let's concentrate on pure relaxation in the arms without any tension. Keep your arms comfortable and let them relax further and further. Continue relaxing your arms even further. Even when your arms are fully relaxed, try to go that extra bit further. Try to get into deeper and deeper levels of relaxation. Let your muscles go, loose and heavy. Just settle back quietly and comfortably. Wrinkle up your forehead. Wrinkle it tighter. Now stop wrinkling your forehead. Relax and smooth it out. Picture the entire forehead and scalp becoming smoother as the relaxation increases. Now frown and crease your brows and study the tension. Let go the tension again. Smooth out the forehead once more. Now close your eyes tighter and tighter. Feel the tension and relax your eyes. Keep your eyes closed, gently, comfortably and notice the relaxation.

Now clench your jaws. Study the tension

throughout the jaws. Relax your jaws now. Let your lips part slightly. Appreciate the relaxation. Now press your tongue hard against the roof of your mouth. Look for the tension. Let your tongue return to a comfortable, relaxed position. Now, press your lips together, tighter and tighter. Relax the lips and notice the contrast between tension and relaxation. Feel the relaxation all over your face and all over your forehead, scalp, eyes, jaws, lips, tongue and your neck.

Press your head back as far as it can go and feel the tension in the neck. Roll it to the right. Feel the tension shift. Now roll it to the left, straighten your head and bring it foreward. Press your chin against your chest. Let your head return to a comfortable position and study the relaxation. Let the relaxation develop. Shrug your shoulders right up, hold the tension, drop your shoulders and feel the relaxation, neck and shoulders relaxed. Shrug your shoulders again and move to the right. Bring your shoulders up forward and back. Feel the tension in your shoulders and upper back. Cup the shoulders once more and relax. Let the relaxation spread deep into the shoulders, right into your back muscles. Relax your back, jaws and other facial areas as the pure relaxation takes over and becomes deeper, deeper and deeper.

Relax your entire body to the best of your ability. Feel that comfortable floating heaviness that accompanies relaxation. Breathe easily and freely. Notice how the relaxation deepens as you exhale. As you breathe out, just feel the relaxation. Now breathe right in and freely relax. Breathe in deeper and hold your breath. Study the tension. Now exhale and let

the walls of the chest grow loose and push the air out automatically. Continue relaxing and breathing freely. Feel the relaxation grow. With the rest of your body as relaxed as possible, filling your lungs again, breathe in deeply and hold it again. Now breathe out and appreciate thoroughly the relaxation. Just breathe normally. Continue relaxing your chest and let the relaxation spread to your back, shoulders and arms. Freely let go and enjoy the relaxation.

Now let's pay attention to your abdominal muscles. Tighten your stomach muscles making your abdomen hard as if you were preparing for a blow to the stomach. Notice the tension and relax. Let the muscles go loose and notice the contrast. Once more, press and tighten your stomach muscles. Hold the tension and study it and relax. Notice the general well being that comes with relaxing yourself. Now, pull your stomach in. Hold the muscles that way and feel the tension that way. Now relax again. Let your stomach out and continue breathing normally and feel the general massaging action all over the chest and stomach. Now pull your stomach in again and feel the pressure. Now, once more, pull in and feel the tension. Relax your stomach fully. Let the tension dissolve as the relaxation grows deeper. Each time you breathe out, notice the rhythmic relaxation, both in your lungs, and in your stomach. Notice thereby how your chest and your stomach relax more and more and try to let go of all the contractions anywhere in your body.

Now direct your attention to your lower back. Arch up your back and make your lower back quite hollow. Feel the tension along the spine and settle back comfortably, relaxing your lower back. Just arch your back up and feel the tension as you

do so. Try to keep the rest of your body as relaxed as possible. Try to localize your tension throughout your low back area. Relax now completely. Relax your lower back. Relax your upper back. Spread the relaxation to your stomach, chest, shoulders, thighs and facial areas. Now flex your buttocks and thighs. Flex your thighs by pressing down your heel as hard as you can. Relax and notice the difference. Straighten your heels and flex your thigh muscles again. Hold the tension. Relax your hips and thighs. Allow the relaxation to pursue it on its own. Press your feet, toes, downwards away from your face so that your calf muscles become tense, spreading that tension as you relax your feet and calves. This time, bring your feet towards your face so that you feel tension along your shins. Bring your toes right up. Relax again. Keep relaxing for a while. Now, let yourself relax further all over. Relax your feet, ankles, calves and shins, your knees, thighs, buttocks and hips. Feel the heaviness of your lower body as you relax still further and now spread the relaxation to your stomach, waist and lower back. Let go more and more. Feel that relaxation all over. Let it proceed to your upper back and chest, shoulders, arms and right to the tips of your fingers. Keep relaxing more and more deeply and comfortably in the chair. There is no tension throughout your torso. Relax your mind, jaws and all of your facial muscles. Keep relaxing your whole body and after a while, you will find yourself deeply relaxed. You will become even more relaxed by taking a really deep breath and slowly exhaling. Take a long, deep breath and let it out very slowly. When you are ready, allow yourself to become aware of your surroundings, alert, awake, refreshed and remaining relaxed. How do you feel?

RELAXATION III

(Courtesy of Suzanne Sampson, R.P.T.)
The goal of relaxation is to leave the everyday, alert level of consciousness and to enter what may be called an altered state of consciousness. Everyone will experience this in his or her own way, but a good beginning is to concentrate on the relaxed, pleasant feelings of the body. By relaxing, you learn to help the body reach its optimal, restful and healing state and you gain new kinds of knowledge and control. Remember that it's a sign of relaxing to occasionally tune out parts of the relaxation script.

Lie back comfortably and let your legs uncross and your arms go heavy and loose at your sides. Let your head be well supported. (Pause)
Start with a deep breath and as you exhale, let all the air out with an audible sigh. Good. Now concentrate on your own quiet, easy breathing. Perhaps you would like to picture this rhythm as if you were gently rocking in a rocking chair or slowly swinging in a swing. As you relax, keep concentrating on pleasant body sensations like breathing. It will help you keep out the intrusive thoughts---thoughts that belong to the active, alert world. When you relax, you will want to focus on pleasant sensations and feelings of letting go. Think of every breath in as fresh clean air entering the body and think of every breath out as a chance to release wastes and tensions. So, let each out-breath be a kind of a sigh. Sigh out the tensions with each out-breath as you continue focusing on your gentle, easy breathing.

Now on the next few out-breaths, turn your

concentration to your chest. With each out-breath, sigh out the tensions from the chest and back. Let your ribs sink in. Let your shoulder blades fold together. Study the increasing relaxation and heaviness of your chest as you let go a little bit more with each out-breath. Concentrate on the loose and heavy feelings as your chest relaxes more and more. Turn your attention to your stomach area. On the next few out-breaths, sigh out the tensions from your stomach and low back. Let your stomach be heavy and relaxed a little bit more with each out-breath. Think about your belly button sinking right through to your back bone. Enjoy the pleasant, let go feelings. Picture a girdle around your waist dropping away---mentally unhook another hook with each out-breath.

Now think about your pelvic area. Concentrate on how heavy and relaxed it can feel. Let the loose, heavy feelings move from your chest and stomach down to your pelvis. Especially concentrate on your buttocks relaxing. Mentally, release your buttocks a little bit more with each out-breath. Let the heavy, loose feelings move from your pelvis to your thighs. Concentrate on your thighs. Mentally, let them roll open a little bit more with each sigh of an out-breath.

Let your whole legs be very heavy and loose. Feel heaviness in your knees, your lower legs and down into your feet and toes--very heavy and loose and relaxed---and let each out-breath relax your legs more and more, sighing out the tensions and the wastes. Begin to feel a good sense of calm and peacefulness. Perhaps, begin to feel a sense of well being and togetherness as you concentrate on pleasant stillness and

heaviness. Let these sensations grown and increase.

Pay attention to your shoulders now and see if they are as loose and relaxed as they can possibly be. Concentrate on your shoulders and let them droop more and more away from your ears, becoming heavier and looser with each out-breath. Sigh the tensions out of the shoulders. Experience the feelings of looseness and heaviness and let them grow and increase. Let your whole arms be heavy, down into the hands and fingers--heavy and still and peaceful. Now, concentrate on the relaxed, heavy feeling of your chest and shoulders moving into your neck and head. Let the parts of your face be loose and relaxed. Let your jaw hang loose and when the jaw is relaxed, the lips are almost always slightly parted. Let your tongue fall back into the bottom of your mouth like a puddle. Concentrate on the loose and pleasant feelings down your throat. Let your cheeks droop, heavy and loose. Think about your eyelids resting gently over your closed eyes like a smooth, heavy blanket. Increase the relaxation of your eyes by thinking about smoothing them out and smooth out any lines around your eyes. Just smooth them out and smooth out the lines in your forehead and just continue mentally smoothing out your whole scalp, even down around your ears.

Your whole face feeling more relaxed now, let your head become heavy. Concentrate on releasing all the muscles in your neck, around from front to back, back to front, and let your head get a little bit heavier with each out-breath. You may feel this release, especially in the back of your neck. Sigh the tensions out a

little more and then a little more, like feeling an anchor chain drop further, further, notch by notch.

Take a moment now and see if there is any part of your body you would like to relax more. Just mentally check through the parts of your body and see if you would like to relax any part more. You may want to use your out-breath as a signal to sigh out tensions. Continue concentrating on the pleasant feelings of warmth or tingling--- any kind of pleasant sensations. Sometimes heavy sensations give way to feelings of lightness. Whatever you feel, let it increase. Imagine the sensations increasing and spreading. If you feel a pleasant sensation in your stomach, let it spread up into your chest, through your armpits and out into your shoulders, your arms and hands, up into the neck and face and head, down from the belly into the pelvis, hips and legs to the toes. If you feel a sense of heaviness, let it increase. Let yourself just sink heavily into the chair. Keep your concentration on sensations and feelings. If you have any intrusive thoughts, turn your attention back to the pleasant sensations of relaxing your body.

Now let's increase the feelings of relaxation. Picture numbers as if they were written on a blackboard, one number at a time, beginning with number 1 and moving to number 10. Each number will increase your sense of relaxtion. You will feel a deeper calm and letting go with each number. Begin with number 1. Picture behind your closed eyelids number 1. Feel a growing sense of heaviness and calm, a nice together feeling. Picture number 2. Let the heavy sensations increase. See the number 3, and more

and more feelings of relaxation. See the number 4 now, more and more peaceful and loose. Number 5. You may feel so loose and still and relaxed that your arms and legs feel as if you don't know where they are anymore and this can be a nice, free feeling. Picture number 6 now and continue to enjoy the pleasant drifting feelings of your deepening relaxation. See number 7 as if it were being written on the blackboard. Number 8. Let your mind get in touch with the inner you as your body relaxes further and further. Picture number 9 and as you do so, you may feel such a sense of looseness and relaxation that you begin to feel very light. Your body is so relaxed that you have a good sense of inner calm and control, an increased sense of togetherness. See number 10 now and focus on any kind of pleasant sensation, feeling more and more together, more and more peaceful and calm. Picture the healing nature of your body in this relaxed state. Imagine all the body systems functioning at smooth idle---very relaxed, very peaceful and calm.

It is good to remember these relaxed feelings frequently throughout the day and you can do that by using a specific word as a stimulus word to help these feelings return. Choose a word like calm, serene or peaceful and say it over and over to yourself. Repeat this stimulus word as often as you like for the next minute or so. Just say the word over and over while the pleasant sensations of relaxation continue.

Very good. Now, let's contrast the sensations of relaxation with those of tension. It is good to be able to identify tension as it begins. You can experience this beginning or surface tension by simply opening your eyes. Keep your body

still and relaxed and just open your eyes for a moment. Examine the feelings of surface tension as you open your eyes. Now close your eyes again. Let the deepened relaxation return and notice the surface tension disappearing. Concentrate again on the pleasant sensations of deepened relaxation. You can experience surface tension another way. Draw in a breath, hold it, and as you do so, notice tension beginning in the chest and notice how it tends to spread out to the shoulders, the neck and into the belly. Now release the breath, go back to normal easy, quiet breathing and notice once again the feelings of deepening relaxation.

Now that your body has begun to relax, you can continue with relaxation of the mind by following the light patterns behind your closed eyelids. Everyone has the potential of seeing light patterns. Often, they are pastel shades of color that shift and change. Sometimes they are brilliant, sometimes black and white. Sometimes they are clear and precise but more often, they are vague pastel colors which continually move. Relax further and don't force them to come, but when you notice them, just follow them--go wherever they take you. If you don't see them yet, you may want to bring them on by squeezing your eyes tightly together for a few seconds. Then relax and notice the light patterns. Whatever you do, see behind your eyelids and just continue to relax and go with it. When you follow your light patterns, go where they take you--let your imagination flow and let whatever sensations or emotions come with them. Just flow and drift.

Sometimes colors can suggest peaceful places--perhaps blue becomes the ocean or the sky.

Sometimes white or pink can be a cloud. See if you can begin to picture the sky or a cloud. Imagine yourself lying on that cloud and feel the pleasant sensation of floating on a soft surface. Continue relaxing your body so that it feels completely and magically supported by the cloud.

Perhaps, if you have trouble visualizing images behind your closed eyelids, you would like to imagine a common object like the toaster in your kitchen, or a gift you are fond of, or a plant. Picture the size of the object. Imagine its shape and dimensions. See its color and picture its texture. Is it rough or smooth. There are many ways to see images. Whatever you experience behind your closed eyelids is OK. Let your relaxation deepen by concentrating on the sensations and emotions and feelings that flow with whatever you see. Continue relaxing and flowing with light patterns or images, feeling a pleasant drifting sensation. Anytime you feel any tension in your body, you can go back to sighing out the tension with each out-breath. Anytime any intrusive thoughts enter your mind--thoughts that belong to the active, alert world, you can continue to focus on the pleasant sensations of relaxing such as heaviness, lightness, warmth or tingling.

Whenever you would like to end your relaxation session, it is a good idea to give yourself a few moments to move from this relaxed state of consciousness back to the alert, everyday level of consciousness. Do this by counting backwards from 5 down to 1. As you get to 1, you will feel more and more like opening your eyes and becoming alert and active. You will feel quite rested and refreshed from the relaxation. Start counting now, if you wish---5,4,3---beginning to

feel like opening your eyes-- 2,1. Now as you open your eyes, take your time and give yourself a large stretch. Stretch out your arms and legs, your torso, your neck, all of the muscles, slowly moving and working and stretching. Notice the nice, refreshed feeling as you stretch. Now, drop back into the relaxed position rather quickly, and with your eyes open and your mind active and alert, just be still for another moment and notice the fine relaxed feelings in the alert state that you felt a moment ago in the relaxed state. Try to carry these relaxed feelings with you for a while and try to repeat these feelings frequently throughout the rest of the day's activities. It is important to carry the relaxation through into your everyday life.

If you feel like continuing your relaxation, just lie back, close your eyes and let your body be loose once again. Let your mind drift and feel free and easy until you feel like opening your eyes and becoming alert again.

MINI RELAXATION

(Suggested by Chuck Strobel, M.D., Ph.D., for mini-relaxation.)
10 second exercises:

1. Become aware of self (if clenching teeth, tight neck, swearing, etc.)
2. Smile at self inwardly and say "What a stupid thing to do to my body."
3. Take easy, deep breaths counting 4 in and 4 out.
4. With 4 out, let jaw go limp, flow down to toes. (The rhythm of breathing is the basic rhythm of life. Try to associate relaxed blood vessels and lower EMG to breathing.)

AUTOGENIC TRAINING

Some therapists prefer the style and intention of autogenic procedures first developed by Schultz in Europe in the 1930's and popularized in the United States by Wolfgang Luthe in recent years. While the procedure as described by Luthe is rather precise, structured and time consuming (taking as long as six months for the first exercise), most descriptions of its present use seem to indicate a shorter, less formal, total procedure. The following scripts are from the Autogenic Training Workshop (Orlando, 1977) and from Green's work at the Menninger Foundation.

Although, autogenic therapy includes a whole host of procedures, the standard exercises are most basic and have typically been most utilized. It is a treatment technique in which the patient uses passive concentration on combinations of phrases. It involves repetitions of verbal formulas, passive concentration and specific postures. The verbal formulas are organized into six standard exercises that are physiologically oriented.

Autogenic Training Standard Exercises:

1. Heaviness: My right arm is heavy followed by other arm, and legs.
2. Warmth: My right arm is warm, etc.
3. Heart: My heart beat is calm and regular.
4. Respiration: It breathes me.
5. Solar Plexus: My solar plexus is warm.
6. Forehead: My forehead is cool.

The practice periods are concluded by flexing the arms, taking a deep breath and opening the eyes. Luthe reports (1977) that in clinical application, about 30-50% of the psychosomatic patients report satisfactory improvement while practicing only the first standard exercises.

Autogenic Training Phrases of Elmer & Alyce Green:

1. I feel quite quiet.
2. I am beginning to feel quite relaxed.
3. My feet feel heavy and relaxed.
4. My ankles, my knees and my hips feel heavy, relaxed and comfortable.
5. My solar plexus and the whole central portion of my body feel relaxed and quiet.
6. My hands, my arms and my shoulders feel heavy, relaxed and comfortable.
7. My neck, my jaws and my forehead feel relaxed. They feel comfortable and smooth.
8. My whole body feels quite heavy, comfortable and relaxed.
9. I am quite relaxed.
10. My arms and hands are heavy and warm.
11. I feel quite quiet.
12. My whole body is relaxed and my hands are warm, relaxed and warm.
13. My hands are warm.
14. Warmth is flowing into my hands. They are warm, warm.
15. I can feel the warmth flowing down my arms into my hands.
16. My hands are warm, relaxed and warm.
17. My whole body feels quiet, comfortable and relaxed.
18. My mind is quiet.
19. I withdraw my thoughts from the surroundings and I feel serene and still.
20. My thoughts are turned inward and I am at ease.
21. Deep within my mind, I can visualize and experience myself as relaxed, comfortable and still.
22. I am alert, but in an easy, quiet, inward-turned way.

23. My mind is calm and quiet.
24. I feel an inward quietness.
25. The relaxation and reverie is now concluded and the whole body is reactivated with a deep breath and the following phrases: "I feel life and energy flowing through my legs, hips, solar plexus, chest, arms and hands, neck and head...The energy makes me feel light and alive." Stretch.

IMAGERY (VISUALIZATION DEVICES)

Psychosynthesis, est, psycho-imagination therapy are just a few of the techniques that employ visualization techniques. They are useful in exploration, relaxation and as metaphors for clarification. There are literally hundreds of such devices. The following are parsimonious and can be elaborated upon:

1. Many people have the belief that they are non-visualizers, and while there may be those individuals, more often they are simply not aware of their ability. Ask the client to visualize their home, kitchen or city describing the color, size and shapes of objects. As individuals describe with eyes closed the details of what they see, they frequently become aware of their ability to "see" images in vivid detail and clarity.

2. Psychosynthesis exploration of the "doors" and "meadow" allows a projective device in which the person is free to develop a visualization that is important to him. In this, the patient is relaxed and instructed to follow the theme of the imagery. "You are standing at the end of a long hall. At the other end are three doors. Walk down the hall and choose one of the three doors and go through it...What or whom do you see? (Pursue the images that develop.) Come back through that door and go through a second one. What is there? (Explore.) Opening the third door, you will see a beautiful spring meadow with wildflowers and tall green grass waving in the gentle breeze. As you pass through the door and into the meadow, describe your feelings. As you continue over a small knoll, you see a person approaching in the distance. Who is it? As you near them, you talk...What are you discussing? You then part and come back through the door returning to where you began." (Discuss experience.)

   When guided by the GSR and, additionally at times, TEMP or EMG, this technique can prove very useful in helping the patient overcome blocks and obstacles in the process of therapy and to provide a type of relaxation and calmness to heighten awareness. When guided by GSR, changes in response in either direction are useful to pursue potentially important material. It often occurs that seemingly neutral visualizations that would otherwise be overlooked produce a GSR response and prove fruitful when followed up.

3. Psychoimagination procedures are especially useful for exploring the personal relationship the individual had between the "mind and "body." It provides a forum for understanding how the person looks at emotions and logical thinking. "Imagine an animal coming out of your head and one coming out of your stomach. (Pause.) What are they? (Description.) Have the two go down a long, dusty, windy road together holding a conversation. (Pause.) What did they say? (Description.) Have them say goodby and go their separate ways." (Discussion.)

4. Space Exercise: Lester Fehmi (1977) has developed a biofeedback and imagery procedure which involves the sequential imagination of spaces between symmetrical parts of the body. The pattern is the following: "I imagine the space between my eyes." (5 seconds.) "I imagine the space between my ears." (5 seconds.) "I imagine the space between my shoulders," etc. The intention is to promote right hemispheric functions in the process of visualization.

RELAXATION AND HYPNOSIS

Most texts of instruction in hypnosis begin with a relaxation induction that is virtually indistinguishable from the relaxation instructions described in this chapter. While the variety of inductions, deepening devices and visualizations are extensive in clinical hypnosis, the same procedures may be used effectively without the use of the word "hypnosis." For many, it is a highly charged word smacking of control by another person "doing silly things," and fear of getting trapped in some "state." For these reasons, some of the devices available may be introduced but without the negative aspects of the word "hypnosis."

CHAPTER V
CLINICAL APPLICATIONS

Introduction

Integration with Psychotherapy
- Requirements of Biofeedback Instruments
- Client Comfort
- Approach
- Therapist as Biofeedback Instrument
- Therapist as Part of Biofeedback Loop
- Phobic Reaction/ Desensitization
- Anxiety States

Integration with Psychophysiological Disorders
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  - Muscle Contraction (Tension) Headaches
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  - Peripheral Vascular Disorders/ Raynaud's
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- Colitis (Irritable Colon)
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Genitourinary
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- Dysmenorrhea
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- Enuresis

Integration with Treatment of Special Disorders
- Stuttering
- Insomnia
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- Alcoholism

Integration with Physical Therapy
- Neuromuscular reeducation and rehabilitation
- Spasmodic Torticollis
- Low back syndrome and pain

Potential Applications
- Epilepsy
- Hyperkinesis

Biofeedback is a learning process and as such differs from the traditional medical interventions of chemotherapy and surgery in that it is not intended to produce forceful changes on the person's physiology or anatomy. It assists the client in learning how to combine the physiological and psychological processes.

Thus biofeedback methods are used in conjunction with a variety of therapeutic approaches including medicine, physical therapy, psychotherapy, nutrition, family counseling, and behavioral techniques. At the same time, non-treatment approaches are possible with biofeeback techniques.

This chapter presents the concept of integration through discussion of stress, the maladaptive response and how the biofeedback techniques are applied in treatment of psychophysiologic and special disorders, in psychotherapy, and in neuro-muscular reeducation.

Since all classification schemes are to some degree arbitrary, the categorizations presented do not represent the only schemes. Some difficulties in categorization occur in the headaches (mixed migraine and tension), insomnia (with its muscular, nervous system, and depressive issues), and other symptoms that fit several classifications or no single classification perfectly. Non-therapeutic uses and preventative medical approaches are subsumed under discussions of stress management and tension reduction throughout this manual.

Although the protocols suggested in this chapter have been successfully used at The Biofeedback Institute, they are only intended to be exemplary rather than definitive methods of treatment. Since patient problems tend to be so unique, new creative and adaptive solutions are frequently required. It is hoped that the procedures described in this book serve to stimulate creative,reasonable and knowled

The biofeedback application section of each disorder is designed to refer back to the procedures described in detail in Chapter III (Clinical Procedures).

"Holistic medicine is a new approach that emphasizes the integration of mind/body processes rather than focusing on the isolated physical symptoms alone."

Integration with Psychotherapy:

It is important to restate the principle that the best outcomes seem to consistently occur where there has been an integration of "talk-time" and biofeedback training of the symptom. The session is divided between discussion of conflicts, environment, dynamic issues, and direct training of the physiological process.

In essence this is how the "psycho" and "physio" merge in the treatment of a psychophysiological symptom. In cases where the symptom represents a learned response and more closely resembles a "habit" than an adaptation to a present life stress,biofeedback training may be sufficient. However, in many cases there is a combination of the "habit" and present stresses and conflicts which reinforce the symptom. Psychotherapeutic verbal interaction and biofeedback training in combination are powerful tools.

Requirements of Biofeedback Instruments Used:

The biofeedback instrument can become either a third entity in the psychotherapy interaction or be seen as an integral part of the entire process. While any instrument which reflects responsiveness and arousal can be useful in the exploration of conflicts, it is better to use relatively unobtrusive ones. These requirements are met by instruments that are small, easy to apply, which do not limit movement, and which use threshold level settings rather than constant auditory signals. In this regard, EMG is too subject to movement effects and is difficult to set for threshold feedback. TEMP is rather slow in response to content, and GSR for these purposes is rapid

and relatively artifact free. The uses of the specific instruments will be discussed later in this section.

Client Comfort: The client's comfortableness with the use of the instrument seems to have a direct relationship to the comfort of the therapist. After initially being apologetic and concerned about the possible negative reaction of the client, the therapist usually finds that he or she becomes unaware of those concerns and the client also accepts the instruments as a valuable part of the entire situation and relationship.

Approach: The electrodes should be placed such that they are unobtrusive. They should not cause discomfort or constant awareness, nor limit movement. When attached at the beginning of the session, the therapist may attach the electrodes while chatting with the client, regarding the process as akin to other necessary mechanical activities such as shutting the door or pulling up the chair. After an initial baseline reading and necessary adjustment, the instrument can be disregarded until it produces some relevant information.

The methods of use vary with the needs of the therapy, including the client's reactivity, the problem, the goals of therapy, the questions that need to be elucidated, and the agreement of the dyad. There are four major ways in which biofeedback instruments are used in a traditional therapeutic setting:
1) The therapist and client both observe the instruments while talking,

2) The patient observes himself with the instruments functioning as a passive mirror of responsivity,
3) The therapist observes and reflects back to the client his interpretation of the feedback either at the moment or later, and
4) The therapist and client both attach sensors to the instruments which are either monitored for later analysis or integrated into the therapeutic process (The interaction of their responses may be an indication of the physiological equivalent of empathy.)

Not all of these methods are useful in every case and some care might be taken to determine which model best serves the goals of the particular therapy.

The techniques involved are dependent on the instruments available and purpose. Typically, it is best to have an instrument which is capable of being set at various threshold levels, and when those limits have been exceeded, an audible tone (binary feedback) is fed back. Occasionally, a light or analog sound will be used, especially if some relative change is of interest. The feedback from the instrument may suggest a shift of focus or going into more depth on a particular topic, but should always be taken as simply one of the many cues available to both therapist and client in the context of the interaction. The fact that some physiological response is being measured does not make it the "right" or "true" feeling. Instead, it is to be seen as additional information in the context of the therapy.

Therapist as Biofeedback Instrument: In a very basic sense the therapist in a psychotherapeutic relationship (dyad) functions as a kind of

feedback modality since he is aware of the changes going on with the client and reflects his observations back to the client in the process. The reflection may be some observation of postural, non-verbal, intonation, or verbal content. It may involve an inconsistency, lack of awareness or disorganization (or strength) on the part of the client. There are, however, limitations to what can be seen,heard, felt or perceived by the therapist and the addition of another channel of communication is provided by the biological information of the instruments.

Therapist as Part of the Loop: As the therapist integrates this physiological information into the matrix of communication channels provided by the client, he becomes part of the loop between instrument and client. It is just as correct to say that the instrument has become part of the loop. In this way the three participants in the process of therapy form an integrated whole. As a "second display unit" to the instrument, the therapist mirrors the total process now including the relevant physiology. He might intervene by asking "What happened just then?" ; or "I noticed that you just had a considerable reaction to the _____".; or even, "You seem to be expressing very strong feelings, but there is very little physical response; what do you make of that?"

The trained therapist can quickly see these comments as not just empty or aimless questions, but a vital part of the transference, exploration, interpretation, and other facets of the treatment.

In addition to the use of biofeedback instruments in a more traditional talking psychotherapy format, there are more specific therapies for specific disorders such as phobias and anxiety reactions.

Phobic Reactions: A phobia is an avoidance response to specific objects, relationships, or situations. It is typically an inappropriate fear in which the patient responds with discomfort, inability, and anticipation of aversive consequences. Although the client may see his response as irrational, logic is of little value in reducing the symptom. The avoidance response is coupled with indicators of arousal such as tension, rapid heart beat, rapid breathing, perspiration, etc. In anxiety states the fear is unknown, and in the case of appropriate fear/flight-or-fight response, the fear is rational. The phobia however has known fear but response is excessive, inappropriate and irrational.

The personality features of the phobic are variable and are often like the obsessive, anxious or hysteroid personality. These patients frequently have obsessions and compulsions as well as physiological signs of anxiety such as dizziness and headaches. In addition, dependence and helplessless are seen. The phobia may have generalized, originating from a traumatically frightening experience or from the fear of some impulse.

Behavior therapy literature has many examples of successful treatment of phobias (Ullman & Krasner, 1968). Biofeedback offers a refinement in both the diagnosis, specificity of focus and object, relaxation training procedure, and process of desensitization. Steps in treatment augmented with biofeedback:

1) Typical history, intake (Including MMPI, fear survey, questionnaires)
2) Behavioral analysis: What is patient avoiding? What are the reinforcers of the avoidance response?

What effect does the avoidance response have on the patient's behaviors in other areas? What other fears are present?
3) Have patient maintain a record of phobic occurance, frequency, intensity and duration; which is continued throughout treatment.
4) Have patient begin to develop a hierarchy, graded list of fears, vivid situations, which are arranged in order of intensity.
5) Using EMG, GSR, and TEMP monitoring review each item of the hierarchy to validate the intensity of physiological response. The hierarchy may be developed in the office or the patient instructed to write it out at home, in which case it is reviewed in the office at the next session. The composite information is most useful in determining response to each hierarchical scene; however, due to movement affecting EMG(artifacts) and the slowness of vascular responding affecting temperature, the GSR has been most often the instrument of choice.
6) Progressive relaxation, EMG relaxation, or other similar procedure is then taught to the patient to obtain a deep relaxation which is in marked contrast to the phobic feelings.
7) Have the patient attain a maximal level of relaxation, and then present each item of the hierarchy, beginning with the least fear evoking scene. The patient is instructed to visualize (imagine) the scene as vividly and completely as possible, and to raise the first finger of the hand which is free of the GSR electrodes at the onset of any subjectively uncomfortable level of fear. The instruments (especially GSR) are monitored during the presentation to ascertain the physiological level of response. The scene is discontinued (i.e. put "out of mind") at a predetermined level of subjective or physiological response.

8) The relaxation training and the "scene" are alternately presented until an absence or minimal response is seen either from the subjective finger signal or the feedback of the instrument.
9) Typically, the therapist does not advance to the next scene on the hierarchy until the previous scene has been desensitized.
10) While in most cases the office imagery hierarchy generalizes to the everyday life situation, it can be enhanced by home practice sessions in which graded series of exercises are prescribed. Additionally, the use of portable EMG and GSR instruments can be worn by the patient in order to observe anxiety levels and facilitate home relaxation.
11) At the end of treatment, the patient is confronted with mild, then increasing, confrontations with the phobic stimuli. This provides mastery and confidence of the success he has been experiencing.

Anxiety States: In addition to the specific treatment of phobias described above, the general approaches of biofeedback relaxation are applicable to feelings of anxiety, and specifically the neurotic disorder referred to as anxiety reaction. Biofeedback is employed in the identification of the environmental, behavioral, and interpersonal factors which trigger and perpetuate anxiety attacks ; and is used to reduce the effects of free floating and situational anxiety and its concommitant inappropriate physiologic stress.

Psychophysiologic Disorders:

Psychophysiologic disorders are those in which emotional factors play a causative role. Usually under autonomic nervous system innervation, the physiological changes (which typically occur with all emotional responses) are intense and sustained. The individual may or may not be consciously aware of the emotional state. Structural changes of the body may result.

Differentiation from Hysterical Neurosis, which is not autonomically mediated and instead represents an involuntary psychogenic loss or disorder of function, is often difficult. The hysteric symptoms usually occur within the context of emotionally charged situations and involve underlying conflicts. A third related category, Hypochondriasis , involves no actual losses or distortions of function, and is dominated by preoccupation with the body or fear of disease.

"If there is psychosomatic illness, then there should psychosomatic health. Biofeedback aids people in taking an active role in managing their own lives."

The Autonomic Nervous System

ORGAN/FUNCTION	SYMPATHETIC	PARASYMPATHETIC
PUPIL OF EYE	DILATION	CONSTRICTION
TEAR GLANDS	--	SECRETION
SALIVARY GL.	--	SECRETION
SWEAT GLANDS	SECRETION	--
BODY HAIR	HAIRS RAISED	--
HEART RATE	INCREASED	DECREASED
BLOOD VESSELS		
IN SKIN	CONSTRICTION	--
IN STRIATE M	DILAT.&CONSTR.	--
IN SMOOTH M	CONSTRICTION	--
IN HEART	DILATION	CONSTRICTION
ADRENAL MEDULLA	SECRETION	--
LIVER	SUGAR LIBERATED	--
STOMACH	IHIB. OF SECR. & PERISTALSIS	STIM. OF SECR. & PERISTALSIS
INTESTINES	INHIBITION	INCR.TONE & MVMT
RECTUM	INHIBITION	DEFECATION
BLADDER	INHIBITION	URINATION
GENITALS		
FEMALE	--	TUMESCENCE
MALE	EJACULATION	ERECTION

Musculoskeletal:

Headache: One of the most common of all symptoms. headaches may occur in the absence of organic pathology or as a manifestation of serious disease. Most headaches are transient, but some are chronic, occuring frequently over a period of months or years. Headaches are a common manifestation of acute systemic infection, intracranial tumors and infections, head injuries or acute diseases of the eye, ear, nose, and throat.All these conditions account for a few of the patients who consult physicians with headaches. Most suffer from tension or migraine headaches.

Headaches may result from stimulation or traction or pressure on any of the pain-sensitive structures of the head, tissues covering the cranium, the 5th,9th, 10th cranial nerves and upper cervical nerves, the large intercranial venous sinuses, the large arteries at the base of the brain, and large dural arteries and the dural matter at the base of the skull. Dilation or contraction of the walls of sensitive vascular channels stimulates nerve endings causing headache. Headaches that occur rarely can usually be related to fatigue, eye-strain or diet. Chronically recurrent headaches require very careful history. Frequency, duration, location and severity, how the headache feels, etc. may help in determining its cause. Arterial hypertension, febrile illnesses and migraine usually cause throbbing pain which may occur in any part of the head, and which frequently involve nausea and vomiting. Headaches from brain tumors and other inter-cranial lesions usually have a steady aching quality,they tend to be intermittent, but usually are present for some hours each day, and may be precipitated by change of posture. At first, they may be localized in the region of the tumor, but tend to become generalized as the inter-cranial pressure increases.

HEADACHE CHART

Cause	Typical History	Physical findings
Vascular (Migraine)	Generalized, freq. unilateral, throbbing around eyes spreading to both sides; Accompanied by anorexia, nausea and vomiting. Sim. periodic attacks over extended per. Family history. Prodromals: changes in mood, scintillating scotomas.	Between attacks phys. exam is negative. Skull X-ray to rule out organic disease. Trial with vasoconstrictor (e.g., ergotamine.)
Muscle Contraction (Tension) (Psychogenic)	Any type but freq bitemporal, constant, generalized, vise-like pain, muscles of scalp and neck. Made worse by emotional disturbance. History of specific stresses with onset.	Appearance freq.bland despite most severe headache, may appear tense, apprehensive. Exam often neg., or tachycardia, elev. systolic BP, moist palms, hyperactive reflexes.
Hypertension	throbbing, paroxysmal generalized, history of CVR disease.	Elevated BP, retinal changes, cardiac findings, edema
Sinus	Frontal, dull, worse in morning better aft. Hist. of prec. upper respiratory infection	Evidence of nasal obs swollen mucous memb., tenderness, discharge

Headaches which persist for months or weeks without letup except in intensity are often associated with psychological disturbances. Headache associated emotional tension commonly starts in the occipital region and spreads over the entire head. Often it is described as a pressure sensation arising within the head or as a vise-like constriction of the skull with cap-like distribution. In any case, understanding and acceptance of the pain as real and not imaginary and discussion of emotional difficulties as well as environmental readjustments and removal of stresses are all necessary.

In the case of tension headaches, which are better referred to as muscle contraction headaches, the individual has responded to stresses in the environment or in their own lives by maintaining chronic contractions typically of the trapezius, frontalis, and other muscles resulting in pain. Biofeedback treatment focuses primarily on the patient's awareness of and ability to discriminate tension and relaxation of these muscles and the learning of effective muscle tension reduction both generally and specifically to the site. Once the patient is adept at lowering both the general relaxation and having less response muscularly in this area to outside stimuli, the persistent headache diminishes. EMG approaches to tension headache are described in detail elsewhere (See Budzynski, et al., 1970, 1973).

In an illustrative case , Mr. T, a 28 year old white male, unemployed college teacher, had had tension headaches since the age of 20 In the last 3½ years these headaches had occured daily, producing severe pain for which he takes a variety of pain killers. Mr. T has had 25 milligrams of valium per day for the last 5 years, which he would like to discontinue, but feels unable to do so. During the headache episodes he finds himself not interested in things around him, becoming irritable, preoccupied with thought of the headache, and experiencing tension across the top of the head and forehead, bilaterally.

During the first session a complete social and medical history was obtained and discussed. His chronic anxiety was explored. At the end of the first session a baseline hand temperature and GSR was obtained; hand temp was relatively nonsignificant (being in the low 90's); GSR, while high, did not show dramatic shifts during imagery of anxiety-producing situations, although his pattern showed a GSR response before he felt any sensation of change. (Typically, patients have an image "in mind" and are aware of it slightly before the GSR responds on the display unit). The most important feature in the diagnostic exploration using biofeedback instrumentation was his extremely high trapezuis EMG (minimum resting level of 25 microvolts), which he was unable to lower through his own efforts at relaxation. During the 2nd session, Mr. T was trained in progressive relaxation, during which time his trapezius EMG reduced from 25 uv. to 16 uv. (relatively high compared to normal populations, but showing marked reduction). He was instructed to practice relaxation for two 15-minute periods daily; upon the 3rd session he carried out the relaxation procedure without instruction from the therapist, with EMG showing a similar (marked)

reduction in muscle tension. In the third session, the patient received EMG feedback with a tone proportional to muscle tension, as well as a meter showing the microvoltage activity of the muscle (in microvolts). Mr. T was instructed to relax himself as deeply as possible, and then to relax more deeply by lowering the tone. With this procedure he was able to achieve 4.5 uv.

In the succeeding 15 sessions, Mr. T continued with EMG training, plateauing at a level of .75 uv. The focus of the training in later sessions was to maintain low EMG levels, not necessarily to reduce the microvoltage further. His headache frequency dropped to a mild occurrence each week , which he was able to relate to specific tension producing events. His need for valium gradually diminished, and his feelings of dependence on its effects dissipated. Mr. T was seen on two occasions at four month intervals following treatment. He reported occasional mild tension headaches after a hectic day of teaching He had discontinued all medications and relied on his successful ability to reduce the tension by relaxation.

This illustration describes the typical case in which the most significant drop in uv of EMG is at the beginning of training, with decreasing reductions in later sessions. The object of continuing training is to have the patient be able to differentiate and maintain the tension reduction rather than returning to previous levels.

Tics: (Habit spasms) are sudden habitually repetitive, purposeless movements often localized to a particular muscle group . Occurring at any age, they are common in nervous children between 5-12 years of age, and may begin as purposeful movements in response to a definite stimulus, but become autonomous. Rarely do they have an organic basis and both sexes are affected equally.

The movements are usually quick and abrupt, involving definite muscle groups in any part of the body, but especially in the region on the head and neck. Common tics include eye-blinking, grimacing, nodding, grinning, swallowing, and shrugging shoulders. Combinations of tics are sometimes done simultaneously or sequentially. Emotion and fatigue intensify the movements which may be inhibited voluntarily and disappear during sleep. Tics should be differentiated from facial spasm, clonic spasms of the muscle supplied by the facial nerve; and chorea, which are haphazard, rather than stereotyped. Tics starting in childhood are often transient and disappear spontaneously; however, when they continue they become chronic and progressive and relapse can also occur. Treatments have included psychotherapy, removing the child from the home environment, improving the situational difficulties in which the tics developed, and phenobarbitol.

Biofeedback treatment of the tic involves an integration of behavioral methods with EMG feedback. Initially, the patient is instructed to produce the undesirable tic and reproduce it rather rapidly in succession. Then he is asked to double or triple the rate of the ticing (Negative Practice). This is done in order that he becomes aware of the movements involved in the tic thus bringing it

under more conscious control. At the same time, the over-use of the ticing response partly fatigues the musculature and produces a response which is not reinforced (extinction). This negative practice procedure is quite effective especially when integrated with EMG biofeedback at the site of the muscle group affected. For example, in a facial tic, a patient with small electrodes placed on the affected site can view on a television screen (closed circuit video feedback) both his facial movements as well as the meter of the EMG. The EMG is conveniently placed either behind his shoulder or above his head so that it is clearly visible on the television screen. The patient may then observe both the metered movements and the pattern characteristics as well as the facial movements of the tic itself. Following negative practice and the doubling and tripling of the tic rate, the patient is asked to stop and observe the absence of the tic.

This initial demonstration is generally successful and allows a very vivid and convincing as well as dramatic initial treatment session. The patient is reassured that while this demonstration does not eliminate the tic, continued practice towards voluntary control may allow him to eliminate the tic completely . The patient is instructed to practice at home in front of a mirror twice each day for 5 minutes with no reinforcement (i.e. music, television, radio, etc.) but for the sole purpose of gaining volitional control over this inappropriate habit pattern .

Charting of the severity or frequency of ticing proves also to enhance the patient's ability, by viewing the progress of treatment. It should be noted that no attempt is made to have the patient inhibit the ticing , but instead to gain a conscious control over it. I have found that requests from the patient to inhibit the ticing typically intensifies the ticing behavior and has usually been tried before the patient came in. Many patients initially refuse to reproduce the tic movements, since they assert that getting rid of the tic, not intensifying it or making it happen, is their desired goal. It may then be necessary to explain the purpose, procedure and importance of the cognitive restructuring process. Typically the initial demonstration described above will do much to involve the patient in successful treatment.

> "For most adults, the motivation of seeing success in the form of a meter movement or sound is enough. It isn't necessary to have flashing lights, electric trains and other gadgets."

Cardiovascular:

Migraine: Periodic vascular headaches which are associated with nausea, vomiting, and visual disturbances lasting from a few hours to a few days with moderate to severe pain. The cause is unknown. However, theories include reflex irritation, allergy, transitory pituitary swelling, and other endocrine disturbances, transient cerebral edema, vasomotor disturbances, and toxins. The clearest evidence indicates that the symptoms relate to a functional disturbance of the cranial circulation. Prodromal symptoms (flashes of light, paresthesias) probably are due to intracerebral vasoconstriction, the head pain to dilation of extra-cerebral cranial arteries (those of the dura or scalp). Increased amplitude of pulsations distends the surrounding pain sensitive tissue. The vasculature itself is healthy and evidence points to a disorder in the neurological pathways regulating the vasomotor response.

Occurring in about ten percent of the population, migraines affect more women than they do men. A history of similar symptoms in the family is common. Often unilateral, there is a distinctive pattern in individual cases. The headache may be preceded by a period of depression, irritability, anorexia, or scintillating scotomas, which may disappear after the headache appears.

Effective preventative measures relate to relief of tension or resolution of conflicts and adjustment to difficult life situations. Although various therapeutic procedures have been recommended for decreasing the frequency of attacks like protein injections, artificial fever, dietary regimens, glandular therapy, sedatives and operative procedures on the cranial artery, none has had success.

Drug treatments have included analgesics such as aspirin, caffeine, and codeine. Ergotamine tartrate (e.g., Cafergot) and methysergide maleate (Sansert) give symptom relief but are not effective for many patients. Potential for habituation and severe side effects have led to a search for effective treatment.

Biofeedback is aimed at learned vasomotor control with temperature training. The patient typically learns to increase hand temperature by vasodilating the vessels of the extremities. This training results generally in reduction of headaches in two ways:

1) The learned hand warming is used to abort the headache at the outset of the prodromal signs by vasodilation and relaxation. (In the case of the classic migraine which has a prior period of intra- and extra-cranial vasoconstriction and sensory prodrome.) These patients are most often quite successful in their outcome.

2) The patient learns to maintain a state of relative dilation by hand-warming and reduction in cranial artery distension. (In the case of the common migraine in which the initial vasoconstriction may not occur.) The common migraine patient tends to continue to have periodic headaches and needs to maintain dilation virtually all of the time in order to prevent their occurrence.

Temperature biofeedback training is typically not effective in stopping the headache once the pain begins or in the midst of the migraine attack since it is difficult for the person to attend to the process and the stretching of the vessels has already occurred.

Essential Hypertension: A disorder of unknown origin characterized primarily by an elevated diastolic blood pressure; associated with generalized arteriolar vasoconstriction. Though the cause is obscure, heredity has been considered an important predisposing factor. Other factors include sodium chloride, renal, adrenal and neurogenic mechanisms.

Defined by blood pressure higher than 95% of nor for any given age and sex; some general limits for normal BP are 150 mmHg Systolic and 90mmHG Diastolic. Diastolic pressures of 90-105 are considered 'mildly hypertensive'; 105-120 ' moderately hypertensive' amd greater than 120 'severely hypertensive' . Systolic hypertension may also occur, especially in the elderly, but is more variable and difficult to categorize. Since blood pressure may change a great deal from occasion to occasion, measurements are generally repeated 2-3 times to obtain a reasonable average.

At the outset, there is no pathological change; the increased peripheral resistance is considered due initially to functional spasm; later arteriosclerosis occurs. In uncomplicated essential hypertension there is no appreciable change in cardiac output, blood volume or viscosity, pulse rates or venous pressure. The peripheral resistance is increased throughout the body and blood flow remains the same because of the concomitant increase in arteriole blood pressure. Mobility of blood pressure recordings is seen in the early state; systolic blood pressure usually increases but at times may be normal and in many hypertensives drops to normal with rest, fever, or removal of emotional tensions.

Hypertension may be present for many years without symptoms or signs other than elevated blood pressure. It first appears early in adult life, usually in the early thirties and these patients may complain of fatigue, nervousness, dizziness, weakness, or headaches at some time. Hypertension is a possibility if the diastolic pressure rises even occasionally to over 90 mmHg; the more often this level is exceeded, the more likely its diagnosis. When emotional, physiologic or arteriosclerotic factors can be eliminated from consideration, then the diagnosis of essential hypertension is based on repeated findings of elevated diastolic pressure when all other causes have been excluded.

In terms of treatment no known therapy can consistently correct the abnormalities and completely reverse the course. No restriction of normal activity is necessary though peaks of unusual physical or emotional stress are undesirable. Excessive use of coffee, tea, tobacco, and alcohol is inadvisable and weight reduction is beneficial. Short term periods of rest, change of environment and mild sedatives may give dramatic results; some tranquilizers may even be useful.

Medically, lowering the arterial pressure when it is inordinately high will reduce the cardiac burden and may also reduce the increased incidence of vascular complication. Effective antipressor therapy can arrest the syndrome of malignant hypertension significantly and prolong life; however, the disadvantages and alarming side-effects limit the usefulness of these agents. Patients with uncomplicated primary hypertension might be seriously considered for therapy if the diastolic pressure is persistently elevated to greater than 110mmHg in males or greater than 115 in females. Rigid dietary restriction of sodium chloride can significantly lower the resting blood pressure in

perhaps 1/3 of the patients. Thiazide diuretic is generally considered to be the first approach, (Chlorothiazide or Hydrochlorothiazide are most widely used). The mechanism of anti-hypertensive action of Thiazide diuretics seems to involve more than just sodium depletion; these compounds may also modify vascular tone. Reserpine and related drugs are often added to the Thiazide therapy. Their use is limited by drowsiness, nasal stuffiness, gastric distress with a bloated sensation and severe depression. They cause bradycardia and effectively block the tachycardia and headaches caused by the hydrolazine which may also produce psychosis, fevers, and rash. Other drugs may interfere with the activity of the sympathetic nervous system and have unpleasant effects such as exertional and postural hypotension, loss of ejaculation, morning weakness, and diarrhea, as well as other side effects. It is unclear whether blood pressure levels should be reduced to the normal range or whether partial reductions are of equal benefit. The medical goal at present is to bring the standing pressure to the normal range and then to consider additional measures to reduce the recumbent pressure as much as feasible.

Biofeedback treatment primarily involves the reduction of the tension and anxiety associated with blood pressure levels and then specific and direct training for lowering of sympathetic activation may be accomplished. Blood pressure feedback itself is somewhat complicated;at present, for effective training it appears that a combination of EMG, GSR (skin conductance) and peripheral blood flow training (TEMP) has the greatest correlation with blood pressure lowering. It should be pointed out that the most dramatic effects in

SUGGESTED BIOFEEDBACK PROCEDURES FOR
ESSENTIAL HYPERTENSION

1 INITIAL RESTING PERIOD (APPROX. 20 MIN.)

2 THREE CONSECUTIVE BLOOD PRESSURE READINGS

3 RELAXATION TRAINING, MONITOR TEMP., GSR, EMG, AND HR.

4 CHECK BP

5 PSYCHOPHYSIOLOGICAL DETERMINATION OF MOST EFFECTIVE INSTRUMENT (GSR & TEMP TEND TO BE MOST USEFUL) ; MONITOR HR TO SEE THAT CARDIAC OUTPUT NOT BEING CHANGED, (S MORE LIKELY WITH EMG)

6 CHECK BP

7 HOME RELAXATION PRACTICE (2X DAY, MORNING AND EVENING, 15-20 MIN EACH) TAKE BP PRE- AND POST- AND CHART ON HOME PRACTICE RECORD.

8 MAINTAIN WEEKLY BP RECORD, NOTE PATTERN, ESPECIALLY CHANGES IN TIME OF DAY, STRESS, RELATIONSHIPS, AND OFFICE VS. HOME. WEEKDAY VS. WEEKEND USEFUL FOR SOME PATIENTS.

(FULLER, 1977E)

terms of lowering blood pressure usually occur in the first few sessions and this could clearly be regarded as a process of desensitization of the patient to the office situation per se. Measures of blood pressure taken daily with portable BP units demonstrate that the highest blood pressures are usually obtained in the doctor's office. Thus, it might be a common situation that the hypertensive patient is normotensive throughout most of the day and when given anti-hypertensive medication, may be in fact overmedicated and have an unnecessary side-effect history or course. Thus, when this patient is seen by the biofeedback therapist, the context is one of learning relaxation and stress reduction in the office situation. The patient typically returns to his own physician having significantly lowered blood pressures; the physician (although possibly surprised at the dramatic reduction in blood pressure after just a few sessions) should not be misled on this score. It should be clear that the initial results are most likely secondary to the reduction of fear and anxiety associated with coming to the office and having the blood pressure taken. While that alone seems to reflect significant benefit, it is not entirely clear how much additional blood pressure reduction is possible physiologically.

Cardiac Arrhythmia: Extra Systoles (Premature atrial and ventricular contractions), tachycardia, and bradycardia , are often related to chronic anxiety and emotional stress. Biofeedback of heart rate as well as EMG/ GSR/ TEMP can be used to train heart rate control. This is best accomplished in an inpatient setting such as a coronary care unit.

See Chap. II, Cardiography for detailed description of instruments and procedures.

Peripheral Vascular Disorders: (Burger's and Raynaud's Disease) may be of either organic or functional origin affecting blood supply to the extremities. The organic disease includes Burger's Disease, characterized by structural changes in the peripheral arteries, veins and nerves. The cause is unknown but extensive smoking is seen as an important factor . Typically occuring in young males before the age of 35, it is infrequent in women or non-smokers of either sex. (C. E. Light , 1976). Onset is sudden, with rapid development of gangrene. The patient may complain of coldness, numbness or tingling or burning before the objective evidence of the disease is present. No specific therapy is available, but medical treatment is directed towards removal of all factors which reduce the blood supply (no tobacco,nor exposure to extremes in temperature, nor trauma e.g. from shoes, nor excessive use of the involved extremity). Cold injury and other peripheral vascular disorders (frostbite) are characterized by injury of the various tissues of the extremeties by cold with secondary structual and functional disturbances of the smaller surface of the blood vessels, primarily coming from exposure to cold with tight clothing, moisture, and inactivity. Frostbite is the destruction of tissue by freezing .

Raynaud's Disease or Syndrome is included in the group of functional peripheral vascular disorders. These may result from disorders, in the sympathetic innervation of the blood vessels or may be secondary to organic vascular disease. However, after the primary functional form has been present for some time, secondary organic changes in vessels often appear. Raynaud's Disease is secondary to many factors manifested by an abnormal degree of vascular spasm of superficial vessels, especially

those in the digits. It may be idiopathic, associated wtih primary vascular disease or secondary to a number of other conditions, usually endocrine or CNS sensitivity to certain substances (e.g. tobacco, certain kinds of trauma e.g. vibration). Attacks are precipitated by overexposure to cold or by emotional upsets. The idiopathic type is rare in males. The pathology includes a produced vasospasm often severe enough to result in changes in the skin (e.g., ulcer) and nails of the extremeties and in extreme cases, gangrene. The attacks may last from minutes to hours and may be painful. Later organic changes include marked dilation of skin capillaries in the involved area. Intermittent attacks of blanching or cyanosis of the digits alternating with stages of rubor are seen. Idiopathic Raynaud's Disease is differentiated by bilateral involvement; by limitation of gangrene, if present, to superficial tissues; and by the existence of the syndrome for at least two years without evidence of primary vascular disease. Therapy depends on recognition, and treatment of the underlying disease.

When the autonomic nervous system has responded in this manner, removal of the cause does not always eliminate the syndrome. In the idiopathic form, no type of therapy has been entirely satisfactory. Many patients improve if they are removed from the precipitating factor, such as trauma or cold; sympathectomy often abolishes the symptom but relief is usually not prolonged , and bilateral operations are sometimes necessary. Mild sedatives are given to reduce the severity of the attacks and aspirin may relieve ache and pain.

Vasomotor control through temperature biofeedback training is clearly a treatment of choice in Raynauds , especially when compared with the alternatives. Skin temperature feedback is used to train for reduced peripheral vasoconstriction and increased circulation. General relaxation, assisted with EMG, is helpful for stress reduction. A plethysmograph may also be used and may be of greater benefit when the constriction of circulation involves a greater underlying tissue area.

A useful approach in the progression of training is to focus on the least ffected digits initially since that is where the greatest likelihood of a demonstra ble change will occur. Hand warming practice sessions frequently throughout the day are important to continue to reinforce the process and to generalize the progress to daily life. See Instrumentation Chapter II for detailed TEMP training procedures.

Raynaud's: the Patriotic Disease.

white hands- overconstriction, reduced blood
blue hands- syanosis, used up oxygen
red hands- reactive dilation, rubor, with burning painful sensation

(From C. Stroebel: personal communication.)

Respiratory:

Bronchial Asthma: A condition manifested by recurring paroxysms of wheezing due to the narrowing of the lumens of the smaller bronchi and bronchioles. It is usually found in individuals with inherited allergic constitution and at least half the patient's allergy is due to external factors like pollens, lint and hair. Also, a precipitating cause may be an infection of the upper or lower respiratory tract. The frequency and severity of attacks may be influenced by secondary factors such as temperature and humidity changes, noxious fumes, fatigue, endocrine changes (as in puberty, menstruation, pregnancy, or menopause) or by emotional stress. These secondary factors should be controlled, since they perpetuate attacks. Biofeedback offers a very useful adjunct in reducing the stress, reducing sympathetic and parasympathetic "imbalance", and possibly reducing the effect of the allergic and other factors.

The physiology of asthma is essentially that the air movement is impaired during the expiratory phase, because of narrowing of the lumens and excess secretion resulting in a characteristic wheeze and prolonged expiration. Later in the attack a ballooning and a temporary acute emphysema-like state occurs. The local reaction in the bronchi is caused by antigen-antibody combination in the allergenic forms of asthma. In the non-allergenic forms, bacterial allergy may be the factor in an inflammatory response. Histamine, aceytlcholine, serotonin and bradykinin have been implicated as possible mediating factors released by the combination of antigen with antibody; however, the evidence is still unclear.

The attack is characterized by a sense of tightness in the chest, wheezing, and frequently a coughing

and spitting. Symptoms may subside in an hour or less , or may continue for several hours or persist as status asthmaticus for many days. Termination of the attack is usually accompanied by pronounced coughing, spitting-up, followed by a sensation of relief and clearing of the air passages.

Typical medical treatment is symptomatic with the majority of attacks responding to epinephrine given subcutaneously. Most adults get little or no relief from antihistamines, but it is sometimes helpful in children. Sedatives (e.g. phenobarbital) are considered useful , but respiratory depression is a danger. Other treatments include oxygen, bronchodilator inhalants and some steroid preparations. Asthma typically demands considerable time and patience in management. Acute attacks at night are often terrifying experiences for the patient and family. The persistence of fear can maintain attacks since many attacks are precipitated by fatigue, overwork, worry, lack of sleep, emotional factors and stressful situations. It is important to uncover disturbances that may exist personally, though it is stated in most medical writings that psychotherapy is seldom successful and that tranquilizers might be helpful. Breathing exercises may be beneficial. A useful exercise is blowing a feather or ping-pong ball across a table. Parents are typically told that only a small minority of children can be expected to "outgrow" asthma spontaneously, and that a larger percentage will worsen unless treated systematically.

There are several biofeedback techniques which we have used successfully with asthmatic patients. These approaches are summarized in the figure, and illustrated in the case that follows.

BIOFEEDBACK APPROACHES TO ASTHMA:

SIMPLEST METHOD USES A CHEST PIECE TAPED TO THE CHEST THROUGH WHICH THE PATIENT LISTENS TO THE SOUND OF HIS OWN BREATHING AND BRONCHIAL SPASM. A BREATHING EXERCISE COMBINED WITH RELAXATION PROCEDURE ALLOWS AN EFFECTIVE WAY OF POTENTIALLY GAINING CONTROL OVER BRONCHIAL SPASMS.

EMG SMOOTHING OF THE BREATHING PATTERN OR THE USE OF A STRAIN RESPIROMETER OR NASAL THERMISTOR GIVES FEEDBACK FOR SMOOTHING OUT THE HALTING BREATHING CYCLE.

GSR AND TEMP FOCUSES ON THE AUTONOMIC INDICES FOR AROUSAL CONTROL. ESPECIALLY USEFUL WITH CHILDREN, REWARD IS GIVEN FOR CHANGES IN THE DESIRED DIRECTION THAT FACILITATE REDUCTION OF SYMPATHETIC DISCHARGE.

LOWERING OF RESPIRATORY RESISTANCE HAS BEEN DONE (FELDMAN, 1976) USING A FORCED OSCILLATION METHOD WITH CHILDREN. LOWERING OF AIRWAY RESISTANCE APPEARS TO BE A POSSIBLE BIOFEEDBACK APPROACH.

Illustrative case: Ginger is a 5 year old girl who was referred with symptoms of asthma. She was hospitalized at the rate of 1 week/month in ICU at the time she began biofeedback treatment, and had been wheezing since age one. The parents are separated; Ginger visits her father once yearly typically. The pediatrician and allergist had the child on several different medications, however , the asthmatic condition had worsened. In the first session Ginger was asked about her understanding of asthma, and described it as her having "an asthma", and did not really understand what caused it or how to control it. In the second half of the hour, Ginger was introduced to the GSR much as if it were a toy, and was instructed to "become quiet inside" and thus, to make the needle go down. She quickly understood those instructions and as she began to practice "becoming quiet inside" the needle would dramatically drop. As she became excited it would rise; the therapist would then ask her again to become quiet inside , and it would drop. This procedure was repeated until she could, with very little effort, raise and lower the needle at her wish or the therapist's instruction.

The philosophy behind this treatment involves an attempt at self-control with which the asthmatic in particular has difficulty. For this asthmatic child the wheezing and asthma attack might represent some attempt at control, or even a learned response to environmental (especially family) stresses. Yet, once learned, the asthma symptoms remain even though the stresses can be dealt with in some way. Thus, the purpose of the treatment will be twofold, as it is in most other biofeedback applications:

1) To offer Ginger a way of controlling her behavior symptoms, now being both painful and dangerous;

2) To provide alternative ways of dealing with the environment around her.

This required the mother's presence at times.

The aspects of control in dealing with stress had to be explored with both the patient and mother, so that it was clearly understood that the therapist would not be taking away from Ginger her ability to respond to stressful situations. She had learned an inapproriate way of responding and now she could unlearn and begin to relearn more adequate responses. Thus, treatment would be focused on Ginger's learning self-control from various aspects.

She was introduced to the temperature device and rapidly, as with GSR, could increase and decrease her hand temperature at will within 15 minutes of experimentation. In combining GSR and TEMP training it was felt that she would gain some control of sympathetic responding which has exacerbated and/or precipitated her asthma condition. Tape recorded sounds of her breathing and the wheezing were made and she was able to quiet her system effectively enough that the wheezing disappeared and the breathing became clear within 15 minutes (combination GSR lowering/ TEMP raising). Her initial training was enhanced by the imagery that she developed on her own , (e.g. that she put her hands in warm bunny fur; or thinking of her chest as a balloon which was being filled and out of which the air was let go.) After the first 2 months of weekly biofeedback sessions, Ginger has not returned to the hospital nor has she had a severe asthmatic attack in over 2 years follow-up. Every few months she comes in for "refreshers", and continues to demonstrate control.

Rhinitis: a symptom complex characterized by seasonal or perennial nasal congestion, itching of the nose and eyes, tearing, watery and swollen discharge, sneezing, frontal headache, injected conjunctiva and swollen nasal mucous membranes. Rhinitis is one of three major forms: acute, allergic and chronic. Acute is the most frequent of the inflammatory nasal disorders which is characterized by swelling of the mucous membranes and nasal discharge and obstruction (e.g. the common cold) usually caused by virus or bacterial infection. The allergic type is due to either hypersensitivity to an allergen or some kind of vaso-motor upset (this type usually occurs when the person gets up in the morning, or is exposed to cold, drafts, or emotional crises.). In chronic rhinitis, irritation of any kind may be responsible, including upper respiratory infections, exposure to noxious materials, sinusitis, etc.

The abuse of vaso-constricting nose drops is a frequent cause of the condition. The chief complaint is obstruction of nasal breathing with discharge, so that the common treatment for both rhinitis and sinusitis is to promote adequate drainage, and most often nose drops are given. However, excessive use of vaso-constrictors should be avoided because secondary vaso-dilation with nasal blockage and increased discomfort may occur.

We have had particular success with the combination of biofeedback relaxation in producing changes in the vaso-constriction and then focused visualization of the nasal passages and sinuses. The person imagines those membrane passages and sinuses becoming comfortably dry and less swollen. As the person proceeds in this relaxation and

visualization he begins to experience a sensation not unlike the effect of nasal spray in which the nasal passages may suddenly clear; there is subsequent drainage down the back of the throat and sometimes a sharp or releasing sensation between the eyes or in the forehead. Since there are so many side effects and complications with nasal sprays this would seem to be a potential useful treatment for a significant number of individuals and especially those who have developed a chronic condition to nasal sprays and antihistamine products.

Skin Disorders:

Hyperhydrosis: Overactivity of the sweat glands produces excessive perspiration which is general or limited to areas e.g. to the palm, soles, armpits or groin. Sweating of the palms and soles is considered psychogenic in origin. It may be a cause of contributing factor in the production of various skin diseases such as fungus, contact dermatitis, etc. In generalized hyperhydrosis, fever or systemic diseases such as anemia, diabetes, obesity, or endocrine dysfunction (e.g. hyperthryroidism) may cause the generalized sweating. The reason for localized hyperhydrosis is unclear, but it frequently occurs in individuals who are otherwise normal but anxious and tense.

The customary treatment for generalized hyperhydrosis includes treating the underlying systemic disease or using psychotherapy. The condition is typically resistant and unmanageable, and an uncontrolled case may lead to annoying complications. Medications used frequently produce side effects. Aluminum chloride solutions or formaldehyde have been used for localized hyperhydrosis, but a sensitization reaction may result. Sympathectomy also produces undesirable side effects including permanently dry hands.

A biofeedback approach which has been effective, although only a few cases have been seen, involves the use of a combination of GSR skin conductance and temperature feedback. After the patient has learned how to control both the raising and lowering of hand temperature and skin conductance, he is requested to vary both in such a way that dryness ensues. The most typical pattern has been initial hand temperature lowering and skin

conductance lowering with subsequent hand temperature raising while maintaining stable GSR. This procedure is then done in the context of context of visualizing emotionally arousing situations to desensitize the sympathetic reaction to stressful situations.

Illustrative case example: Mrs. K is a 23 year old married housewife who was referred by her physician for biofeedback treatment of her resistive hyperhydrosis. Her hands and feet sweated profusely and had done so as long as she could remember. Frequency of the symptom was estimated at 50% of the day. Previous treatment included tranquizers, Robinal with Phenobarbital , and diuretics. One physician's prescribed treatment was that the patient wash her hand with formaldehyde and put plastic bags on her hands and feet with rubber bands before bed; she commented that this made sleep very uncomfortable.

The patient, who is a cosmetologist, is particularly affected by her symptoms in that she has to apply makeup and do hair for customers. Her hobbies were also greatly affected, which included knitting (she could drench a ball of yarn).

The treatment included the use of temperature feedback, GSR/moisture detector(having both a baseline measure and feedback of surface moisture of the hands); homework (including a history of the hyperhydrosis, some of which was obtained from other family members), and a daily record of sweating. In addition, a deep muscle relaxation training was initiated.

The patient was seen for a total of 8 visits. She learned hand cooling quickly; she could volitionally cool her hand temperature(skin surface)

from 86 ^{o} to 74 ^{o} F. in 5 minutes by the third training session. It was explained that the purpose of the training was not to cool her hands, but to be able to influence hand moisture by cooling them when they are hot, and warming them when they are cold.

The GSR was used in conjuction with visualization of stressful scenes, and habituation of GSR responses to these scenes was obtained. Within the first 3 sessions the patient was able to readily cool her hand temperature (both hands tracked within .5degree), and she was able to stabilize GSR. Mrs. K learned to raise and lower GSR (at a very gross setting so that it operated as a moisture detector), which thus indicated the amount of moisture on her hands. She, thereby, readily became aware of the parameters of turning "on and off" palm sweating. Her hand sweating record for the first 4 weeks showed dramatic decrease in the symptom each week. By the 6th week her hands were sweating only once or twice a day, for no longer than 15 minutes. In the final session, the patient could literally turn on and off her hand moisture by ostensibly warming and cooling her hands. She asked to continue treatment for a different problem, moderate overweight. She no longer experienced the hyperhydrosis severely as of the 8th session, nor at subsequent follow-ups.

Gastro-intestinal:

Colitis refers to actual inflammatory disease of the colon, such as ulcerative colitis. The spastic or mucous colitis is a functional disorder and is most properly described by the term "irritable colon". Chronic ulcerative colitis is a non-specific, inflammatory ulcerative disorder of the colon characterized by the passage of bloody mucous. The cause is unknown, although it has been attributed to specific bacterial and viral infections and to psychogenic disorders in which nervous stimuli induce spasms, thus damaging the colon, and permitting bacterial invasion. Also implicated has been hypersensitivity to food, food products (e.g. milk), and to auto-immune processes in which the body makes antibodies against its own colonic mucosa. Tiny abcesses may occur and eventually destroy the muscular coats of the bowel. In severe cases there are large mucosal ulcerations. While arrest or healing may occur at any point, even mild cases rarely result in a return to normal, and residual scar tissue remains which is tender and bleeds readily. This disorder occurs at any age, but most frequently is in young adults of either sex in their 20s-40s. Onset can be acute and most often is slow with increasing urgency to move bowels, mild lower abdominal cramps and/or the appearance of bloody mucous in stools. If the process extends upward the stools become looser and eventually the patient may have 10-20 bowel movements a day often associated with severe rectal distress and cramps, which may occur even at night. The objective is to rest the bowels as much as possible and to support the patient's strength and nutrition so that his own defense mechanisms may combat the disease. Bed rest and fluid intake,, adequate caloric intake with emphasis on protein, and antibacterial agents or cortical therapy is used. Psychotherapy is indicated since the person with ulcerative colitis is discouraged and apprehensive and may feel abnormally dependent and

may need constant encouragement. The therapist will need to be tolerant towards the patient's many complaints. Emotional problems must be dealt with and difficult environmental factors eliminated.

Irritable colon or mucous colitis is a common motor disorder of the large bowel with variable abdominal discomfort and irregular, predominantly constipated, bowel habits (spastic colitis, although this condition is not truly inflammatory). The patients are typically tense, anxious and hurried, of long-standing faulty habits, such as rapid and irregular eating, or repeated failure to eat, the urge to defecate, the abuse of laxatives and enemas, the extended use of broad-spectrum antibiotics. The physiology includes irregular and non-propulsive contractions instead of the orderly storage and evacuation of feces. These contractions retard the evacuation of feces which may become excessively dehydrated and hard. Gas is not expelled normally, but is trapped and compressed causing sensations of bloating and fullness. Excessive formation of the mucous normally produced in the bowel is present and sometimes constipation alternated with periods of frequent and loose bowel movements caused by hyperreactive peristalsis. Bowel movements may be incomplete and unsatisfactory and bouts of diarrhea may interrupt the constipation.

Therapy of the irritable colon usually is not considered successful unless both the psychological and physical aspects have been treated. The physician is instructed to advise the patient that the disorder is functional, that he should break the laxative or enema habit which will at first aggravate the symptoms but will bring ultimate improvement, and that rest and relaxation are important therapeutic goals.

In the treatment of colitis, biofeedback training offers three separate procedures. The simplest and most direct is that of having the patient listen to his own intestinal sounds with a stethoscope or amplified microphone, such as an electronic stethoscope. The patient is then asked to quiet the sounds, whether it be gurgling or grumbling, to smooth out the erratic quality of the movement (peristalsis).
For the patient for whom tight abdominal holding has become or is associated with the irritability, EMG electrodes can be placed upon the abdomen and the patient then reduces the tension level on the EMG. A third method which is considerably more complicated in terms of instrumentation required, involves the use of the very low frequency filtered EMG. This device operating at an average of 2-cycles per minute is essentially a transducer for the peristaltic action.
The tracings of the colonic movements is seen on chart recorder and the patient asked to reduce the amplitude of the needle swings, thus, over time, reducing the contractions from vigorous to mild ones. It should be noted that general EMG relaxation itself in combination with some relaxation training procedures is often sufficient to reduce or eliminate the irritable colon.
As the patient learns to relax effectively, the colonic spasms should be reduced.

Peptic Ulcer: A specific erosion of the mucous membrane of the lower esophagus, stomach or duodenum. The mucosal areas are exposed to acid - pepsin secretion. While the cause is unclear, over-secretion of gastric juice appears to be an important factor in the production of duodenal ulcer and the reactivation of the old ulcers. Psychic disturbances with increased emotional tension, psychological conflicts play an important role in the mechanism of ulcer formation. "Stress ulcer" is an acute ulceration of the mechanism of ulcer formation. "Stress ulcer" is an acute ulceration of the stomach and duodenum. Clinical manifestations of the lesion include upper gastro-intestinal bleeding under emotional stress after surgical procedures, or in patients under steroid treatment. If the acute bleeding cannot be controlled by usual methods, gastric cooling and sometimes surgical procedures are used. The pain pattern of the duodenal ulcer is more likely to be the classic pattern of hunger pain, food ease and periodicity. In patients with gastric ulcer the pain pattern is more variable and the incidence in women is close to that of men (in the duodenal ulcer it is ten times more frequent in men: C. E. Light, 1976). The presence of ulcerating lesion in the stomach raises the possibility of cancer (carcinoma). In esophagael ulcers there is pain near the sternum with heartburn gastric distention, nausea, vomiting salivation, some weight loss, diarrhea, and anemia (from

The objective of treatment is to heal the ulcer and to keep it healed and often the ulcer therapy may have to be continued indefinitely as there is no way of anticipating recurrences. Principles important in the medical treatment of ulcers are: 1) Rest; mental, physical and gastric; 2) suppression of gastric, motor and secretory hyperactivity; and 3) improvement of the nutri-

tional status of the patient, particularly with regard to protein. It is typical for the gastric ulcer patient to spend three weeks in treatment in bed rest, usually in the hospital; for duodenal ulcers usually only a week or two is needed, or even just bed rest at home.

Biofeedback implications in this disorder appear obvious , primarily focused on training the patient in stress management, relaxation training, and generalization of low arousal (perhaps through mini-relaxations throughout the day).

EMG, GSR, and TEMP feedback is done in the office. Relaxation exercises and awareness of tension indicators (e.g., jaw, neck, breathing tension) is emphasized at home and throughout the day. Thinking about and being more relaxed should become part of the person's life style even though they remain active and energetic. Medical therapy typically does not attempt to change the person's life style and focuses specifically on the symptom relief. Biofeedback procedures attempt to refocus on the causes of the disorder.

We have had particular success with Colitis and Ulcer patient groups in which relaxation and sharing of problems and progress are combined with the biofeedback training.

Fecal Incontinence involves the inability to control the act of defecation (involuntary bowel movements). While there are many causes, the mechanism is an imbalance between the tone and the contractility of the sphincter levator mechanisms and the force exerted by the intestinal musculature. Impairment of the sphincteric reflex to distention of the rectum can result in incontinence which may be due to neurologic disorders, muscular disease, congenital defects, trauma or surgery. Incontinence can also occur in the presence of a normal sphincter-levator mechanism if the intestinal musculature is over-active, as in colitis. The treatment has been typically that of surgery.

Biofeedback treatment involves equipment specifically designed for this purpose. Operant conditioning of rectosphincteric responses is accomplished by monitoring internal and external sphincter pressures with a Miller-Abbot balloon with 50ml capacity while the patient watches pressure tracings and practices contracting the external and relaxing the internal sphincter, (Engel, et al., 1974) . In this research, 6 male subjects with long-standing fecal incontinence who had failed to respond to all other treatment learned control in 4 sessions or less. In follow-up of 6 mo.-5 years, four patients remained completely continent, and two definitely improved even when the incontinence was secondary to organic lesions. The normal rectum has a reflex to contract external sphincter when the rectal bowel gets distended. In this disorder the person must relearn the process by using new pathways because the reflex is disrupted (e.g. by stroke, surgery, MS). The patient can then see the relaxation and contraction of both sphincters and learn to differentially control their actions thus regaining control over the involuntary loss of feces.

Genitourinary:

Impotence: is the inability of the male to perform the sexual act. Medicine generally sees four causes : 1) diseases of the genitals such as structural defects, scrotal masses, prostatitis ; 2) endocrine problems such as hypogonadism, hypothyroidism ;3) endemic disorders such as diabetes, spinal cord infections, fatigue, x-ray, alcoholism or drug dependence; 4) psychic factors such as inferiority caused by premature ejaculations or fear of impregnating the partner, or contracting venereal disease, or revulsion from the partner or her surroundings.

Psychic impotence frequently is specific (for example, with wives, virgins or prostitutes), rather than absolute. Psychological factors are responsible for most cases of male impotence. The standard treatments for impotence include psychotherapy intervention or behavioral measures involving reinforcement techniques.Masters and Johnson techniques are now integrated into marital therapy or couple-counseling framework. Relaxation/ hypnosis approaches with both positive suggestions , exploration of traumatic feelings, and restructuring of attitudes are used.

Biofeedback procedures can be integrated into any of the above techniques whether by exploration or with use of the GSR e.g. of traumatic areas in particularly charged issues concerning sexuality. For example, early sexual experiences might be explored with the use of GSR in psychotherapy in such a way that more rapid uncovering of the hetero- and homosexual feelings are possible. Biofeedback assistance of behavioral therapy techniques would be the showing of positively reinforcing slides accompanying arousal responses either with the penile erection feedback unit

(a device which uses a mercury strain gauge loop that goes around the corona of the penis and feeds back a varying click rate proportional to the penile tumescence). This allows direct auditory feedback to the degree of erection, penile arousal elicited by either scenes from slides or imagery, a combination of GSR arousal as well as the penile feedback can be used and interfaced with the more sophisticated relay apparatus which then controls whether the slide projector or the tape recorder gives "sensual rewards".

In the application of Masters and Johnson techniques, biofeedback instruments can be used to enhance a couple's awareness of each other's areas of arousal. Couples can be counseled on the use of GSR and/or the penile erection feedback unit (PERF) and they can take the instrument home using the feedback as guides to learn better how to stimulate their partner to a pleasurable response. While this may seem initially mechanical, it is of great value for the patient who has difficulty verbalizing or subjectively experiencing pleasurable touches or responses. It may be used in such a way that it becomes a game in which both partners can participate in a mutual exploration.

GSR has turned out to be of more value generally because of its ease of use, and the more total general arousal feedback which it relates. The PERF unit frequently tends to be confusing to use because of the artifacts produced by movement which can influence the stretching of the mercury strain gauge giving false feedback. The person has to be virtually still when using the PERF unit. However, the couple using either one or a combination of the instruments can explore through massage, touching,verbal stimuli, and other methods which produce the most pleasure for the

partner. A note should be made that the instruments can provide some defocusing away from the point of high emotional charge which may have prevented the couple from actively exploring their sexual distress and discomfort. They may now focus on a "third party", the instrument, which in the privacy of their own surroundings, provides information on their performance and physiology. (Fuller, 1977a).

In the case of biofeedback-assisted hypnosis and relaxation there is a direct and clear application in that sexual responsiveness requires a particular sympathetic balance to be achieved. Relaxation in the context of sexual excitement allows a full and controllable sexual response in orgasm, whereas fear, anxiety, anger and depression are antithetical to the ability to maintain an erection, to allow ejaculation and to have climax with satisfaction. In addition, in this hypnosis/relaxation approach, positive suggestions might be given in combination with the deeper relaxation procedures. Both EMG and GSR are most helpful here, as the patient moves toward a more virile, healthy and vital view of him or herself in relation to the partner. Guided imagery allows interweaving, exploration of thought and fantasies, and fears associated with sex.

After other procedures have been used in a stepwise fashion, and with a clear understanding of the implications and limitations, the therapist can instruct the patient in the use of the PERF unit. The patient would apply the mercury strain gauge around the corona of the penis (in the restroom), leave the cord and plug out of the pants (either through the zipper or above the belt), and return to the therapy room. The therapist then can attach the plug to the PERF. The therapist and the patient with good rapport can effectively

explore areas of sexual trauma, excitement and fear; allowing feedback from the PERF and GSR to provide information for guiding the imagery and exploration process (For a controlled study on penile tumescence, see Rosen, Shapiro & Schwartz 1975).

Also see (Instrumentation) Chapter II for a more compete description of the penile erection feedback unit.

Dysmenorrhea: is painful menstruation, as distinguished from menstrual distress in which headache, nausea and nervousness (but no pain) is present, and from premenstrual tension. While the etiology of dysmenorrhea is unknown, the condition occurs only during ovulatory cycles and may be associated with endocrine imbalance, the position of the uterus, or pelvic inflammatory disease. It may improve upon satisfactory marital relations or following pregnancy and is aggravated by psychic and emotional factors. The pain producing mechnism is unknown. It has high individual variation but may be secondary to uterine spasm, contraction or vascular change. Pain is usually described as cramp-like, mild to severe, and usually located in the lower abdomen, but it can also be felt in the thighs and back. It may occur just before or during menstruation and persist for a few hours or throughout the menstrual period. Treatment has generally been exercise and sports participation, postural exercise , pelvic circulation and pain medication. Heat has often been used. Psychotherapy has been used with patients in whom the condition has been incapacitating.

Biofeedback approaches, preliminary at present, include general relaxation with EMG and particularly hand temperature raising. Specific approaches in which the EMG is used include training the muscles of the pelvic floor, and vaginal temperature training to increase blood flow in the vaginal wall.

Dyspareunia and vaginismus: a painful or difficult coitus which is frequently due to vaginismus, a spasm of the vagina. Dyspareunia may begin with first attempts at sexual intercourse. The spasm may be psychogenic or result from local trauma such as tears of the hymen or bruises of the urethra meatus. Proper physiologic lubrication is lacking and the resultant trauma may cause pain. Forceful pressure against a sensitive urethra during intercourse may be a factor. Psychogenic factors include fear of sex and intercourse in general (forceful and painful intercourse, faulty up-bringing, ignorance of anatomy, fear of pregnancy or aversion to the partner). Occasionally, lesions or defects or rigid hymen is found. Heat is used for relief and lubrications are used just before intercourse. Patients are also trained to insert increasing sizes of test tubes, well lubricated, for 10 minutes each session, a procedure which has both mechnical and psychological advantages. It helps stretch the vagina wall and accustoms the nerve endings to presence of a foreign body at the same time allowing a kind of desensitization of concern with that area as being forbidden. It may be suggested that after insertion of the tube in the third week (session) the coitus would not only be painless but also pleasurable. Biofeedback treatments involve the use of a Kegel Perinometer (see Chapter III) which is essentially a conically shaped latex insert , which when squeezed forces air through a tube register on a pressure guage meter. The patient can then see her own ability to contract the musculature of the pelvic floor, and exercise, becoming acquainted with, and strengthening the muscles involved in intercourse. In the process she may become more in touch with that portion of her body.

Enuresis:which is involuntary bed wetting usually during sleep by children over the age of 3, must be differentiated from incontinence which may occur when the patient is awake,and from neurogenic bladder.If after evaluation for neurologic disease, renal deficiency or some organic disease, the enuresis still persists beyond puberty despite conscientious therapy or counseling, behavioral methods related to biofeedback might be most effective.

A graded step procedure moving from the simplest to more complex treatments is preferred. For example, counseling on regular bladder habits, educating the parents about toilet training and reducing the use of punishment may be immediately effective. Exposing issues of hostility or secondary gain in attempting to remove these reinforcers provide a second step. Requiring the child to empty the bladder at bed time and awakening the child completely just before the usual time of bed wetting (usually 2 hours after going to sleep) and having him urinate is helpful. Then increasing the time interval for awakening gradually may be effective, although time consuming, taking about 6 months. Focus should be on praise and reward for any improvement, never reproachment or punishment. Excitement and fatigue should be avoided. A device which is essentially a moisture detector may be placed under the bed sheets which awakens the child when he urinates has also been found helpful in gaining conscious control in the process. These devices in combination with counseling and parental guidance are typically effective.

Integration with Treatment of Special Disorders:

Stuttering: a speech disorder associated with anxiety and stress, involves tension in the articulators, improper breathing, tongue thrusting, and/or vocal cord shutting. Biofeedback training in combination with speech and behavioral methods is employed. EMG training for relaxation; mouthing and whispering to get a light touch; and progressively graded steps of difficulty in reading practice may be coordinated. The progression is from words to sentences, from repetition of reading material to spontaneous speech. A hierarchy of speaking situations can be desensitized first in the office, talking to friends, authorities, and large groups.

GSR can be used with stutterers in a desensitization process. This is especially effective with phone stutterers. In stuttering related to tension levels , a vicious cycle of blocking is frequently developed. By using GSR rather than EMG there is not the difficulty of muscle movement, although a combination is sometimes used.

In the illustrative case example, a 32 year old male, junior executive, was a phone stutterer who stuttered when he answered the phone for as long as a minute before saying "Hello". Bright and effective as a person, the stuttering interfered greatly with his life. He has had some stuttering since childhood.

After relaxation training facilitated with EMG, and some exploration of the variables of the problem, GSR training was done. When some control had been achieved, the phone desensitization process began. He was to maintain a low arousal, taking about 15 minutes to have the GSR at a low level of conductance, then call someone. An alternative was to have the secretary call in for him

to maintain a low arousal while on the phone. If he began to get an increase in arousal as he was dialing the phone, he was to stop, reduce the GSR and continue only if below a predetermined criteria. This continued until he could perform an activity such as talking on the phone while keeping low GSR. He finished dialing the phone, and attempted to maintain low arousal while the phone was ringing. If there was an increase, he was to bring it down while the phone was ringing. Fortunately, on his first attempt, the phone rang several times and he was able to bring the GSR back down. In one case he called a girl friend who's name he had never been able to say on the phone, and was successful in saying "Cathy" without a stuttering episode. This was a rewarding experience for him and allowed an "on-line" way of using the instruments.

> "Responsibility is shifted from the doctor to the individual."

Insomnia: refers to the inability to sleep for an "adequate" amount of time. This amount of time is individual and variable, and it is found that many who complain of insomnia sleep as much as the normal population. The most common presenting problem is delayed onset of sleep. Depression is implicated in sleep duration insomnia (in which the person has early-morning awakenings). Commercial sleep preparations and prescription medication have both been criticized, and are considered to adversely affect the quality of sleep as well as produce side effects and dependency.

The biofeedback procedures include EEG frequency shaping and successive lowering of brain wave frequency toward sleep. This technique is most effective with patients who cannot "clear their mind" of the days problems or worries of tomorrow. Especially true for the obsessive individual, the biofeedback training has as its goal the relearning of the natural process of frequency reduction and "quieting" for rapid, effective and non-medicated sleep.

EMG training for muscle tension reduction is most effective for patients who have a peaceful mental state at bedtime but feel physically tense and restless. They may be unable to relax and feel rigid and uncomfortable. The goal is to learn muscular relaxation and a rapid reduction in muscle tone.

Illustrative case example: A 36 year old male cardiologist with a busy group practice, happy home and marriage, no clear sign of depression or complicating mental distress, but a 10-year history of sleep onset insomnia (45 minutes - 1½ hours, corroborated by his wife) and sleep duration

(3-4 hours uninterrupted with inability to return to sleep). He exercised sufficiently, ate well, and received little relief from Dalmane. The symptoms worsened in the last 3 years. Patient was trained in Jacobson's Progressive deep muscle relaxation (alternate tension/relaxation) and baseline EEGs were obtained. He was instructed to practice relaxation training twice daily, and returned for weekly appointments. Each week his EEG (occipital left hemisphere) frequency was shaped (reinforcement given for below average frequency production), from a beginnning of 16 Hz. By the 8th session he was obtaining 9Hz average, reporting a floating-in-space sensation , and blank mind which was pleasant for him. By the 12th week he was obtaining 6Hz averages, reporting hypnogogic imagery, and falling asleep in the office within 15 minutes. His sleep records showed 20 minute onset, 6-7 hour duration. By the 14th session he was no longer taking medication, sleeping 7-8 hours uninterrupted, relaxing in the office and falling asleep in 10-15 minutes. (Note: One weekly appointment was missed, which regressed him to levels of two weeks prior.). He was terminated after 18 sessions. Six-month follow-up showed stable sleep pattern of 7 hours.

Bruxism / Temporomandibular Joint Syndromes: The ability to differentially control the left and right masseter can be improved by bilateral EMG biofeedback training. Although normally balanced, the masseters can contract independently. Lack of mandibular stabilization during chewing places stress on the temporomandibular joint and muscle which may lead to facial pain and chewing problems, (Rugh, 1977).

Alcoholism: Biofeedback is used adjunctively to rehabilitate and in psychotherapy, in order to facilitate relaxation and stress management as well as to engender conceptually the sense of self (personal) control. The assurance that he has control over his anxiety states or tension in interpersonal relations can greatly enhance the alcoholic's reduction of alcohol consumption. The stimulus to drink in order to reduce tension is decreased if he functions more effectively in a stressful environment.

Integration with Physical Therapy:

Neuro-muscular reeducation and rehabilitation procedures with biofeedback training can accelerate the process of increasing the neuromuscular activity of dysfunctioning muscle groups. The muscle activity ,even though not visible, can be detected and fed back to the person by means of the EMG. In conjunction with retraining exercises the person can often learn to regain control over still functional muscular activity and extend function to control greater areas. Applications in this area are extensive.

Categories of EMG biofeedback applications include: pain syndromes; muscle spasm and chronic contractions; post-operative rehabilitation; paralysis;torticollis; cerebral-vascular accident (CVA, stroke); and specific conditions such as drop foot, Bell's Palsy,and cerebral palsy. There are further applications in the development of automated prosthetic devices. Neural control of artificial limbs is being studied.

Important aspects of neuromuscular procedures include: the necessity of working with both the agonist and antagonist muscles; the use of standard procedures such as exercise, heat, massage, and gait training; and, tremendous patience in the slow and tedious process of helping the patient regain muscular control. In addition, the therapist must be attentive both to muscle relaxation and muscle strengthening. With guidance, the individual can learn to inhibit the activity in one muscle, and develop activity in another, selectively. In the course of neuromuscular reeducation, psychological issues may come to the fore, and should be integrated into the total scope of treatment,which may include consultation with a psychotherapist .

Spasmodic Torticollis: (wry neck) is a tonic or intermittent spasm of the muscles of the neck resulting in rotation or extension of the head. While the cause is unknown it is sometimes a disease of the basal ganglia or symptomatic of psychological disturbances. Onset is in adulthood with both sexes being equally affected. No pathology is found in the brain,and while onset is usually gradual it can be sudden. Superficial and deep muscles of the neck particularly sternomastoid and trapezius are involved. Contraction of the affected sternomastoid muscle causes rotation of the head to the opposite side and flexion of the neck to the side of the contracting muscle. If there is tonic, sustained rotation, or intermittently repeating jerky movements of the head to one side; soon the sternomastoid on the affected side may become hyperthrophied. Medically, it has been a persistent and difficult symptom to treat, and while spontaneous remissions occur, the condition usually persists for life. Treatment with collars or casts of the neck are ineffective. Occasionally the spasmodic torticollis can be inhibited temporarily if the patient exerts slight pressure on his jaw on the side to which the head is being rotated. Some surgical procedures such as a section of the spinal accessory nerve stretching the shortened muscle have been attempted but given up.

Biofeedback treatment has been shown to be highly effective, and at this point is considered by many to be the treatment of choice. This involves the use of dual EMG in which electrodes are placed on opposing sternomastoids. The patient is trained to enhance the one muscle group and inhibit the other. This achieves a rebalance, thus reducing the rotation.

Low back pain: Pain in the lower lumbar, lumbosacral, sacroiliac region of the back is usually accompanied by pain radiating to the legs and the distribution of the sciatic nerve, which may be more severe than the back pain itself. The causes include a physiologic dysfunction elsewhere in the body such as backache associated with menstruation, infectious disease and prostatic disease. Psychogenic backache is often an aftermath to an actual injury or organic disorder. The history may include a strange movement of pain up and down the back and elsewhere, the association of pain with mild activity, and similar symptoms elsewhere in the body.

Treatment tends to perpetuate symptoms rather than alleviate them. Malingering could be present, but difficult to prove. The second major cause is specific disease of the vertebrae which is tuberculosis infection, osteoarthritis, or old age. A final cause is a local mechanical defect. Sprain of the lumbosacral or low lumbar joints commonly occurs after lifting a heavy object, from an unexpected twisting of the trunk, or even from bending over. Typically the patient feels sudden pain near the midline which may prevent him from straightening out. The pain often then becomes worse in a few hours, although in some cases severe symptoms do not develop immediately. There is obvious distress, a list to one side, tenseness in the paravertebral muscles. Motion is restricted by pain. Neurologic findings in the legs and X-rays are negative. Recovery from a single attack is good. Recurring episodes of sprain indicate the person is likely to continue having them. In some patients with injury to a major vertebral disc or ligaments eventual development of intervertebral disc syndrome is probable.

The most effective treatment is bedrest, analgesics, heat and massage.

Chronic low back pain (structural inadequacy) is a condition which is the result of relative overload on the vulnerable structures in the lumbosacral region. Spinal abnormalities are more vulnerable to stress, and are more apt to decompensate with resultant pain. An inadequacy of the supporting musculature, chiefly the paraspinal group and the abdominals. Weakness may also follow disease, but is most often the result of sedentary life . The load carried by the low back includes not only the body weight and type of activity but also the efficiency with which a person uses the back.

Thus a person who keeps in good physical condition, balances activity and rest, who uses the trunk skillfully, may never have a pain even if there is a conspicuous bony anomaly. The typical history of a patient with low back pain from structural inadequacy is the persistent recurring ache in the lumbosacral area, variable in severity and alleviated by rest, aggravated by activity. The aching is not enough to prevent ordinary activities but acute pain may be felt on top of the chronic ache. Pain spreads laterally but true sciatic radiation does not occur. Range of motion may be only slightly decreased with some painful limits. The trunk muscle strength is normal but thus may reveal inadequate functioning .

Treatment includes load lessening, analgesia, correcting structural weakness, adequate bedrest, lessening of obesity, sleeping on a firm mattress, improving posture and advising the patient to use legs to keep trunk straight when lifting loads. Local heat, aspirin, physical therapy, exercise,

and corset support are all given. Medically, spinal fusion which corrects for structural weakness by creating a solid bony bridge over the involved area has been seen as operatively helpful for emotionally stable patients with backache which fails to respond and is bad enough to interfere with normal activities (4th and 5th lumbar vertebrae to sacrum).

Biofeedback treatments include the strengthening through EMG of opposing muscles for rebalancing both the posture and weight/load bearing capacities of the person and also generalized relaxation in order to interrupt the "pain cycle". The vicious pain cycle which typically occurs in both acute and chronic cases consists of an initial pain to which the patient braces and maintains more chronic muscular contraction of the back and abdominal muscles. This results in fatigue and exacerbation of the original pain with the now chronic holding of these muscles even after the original pain has subsided. Chronic muscle contractions continue, perhaps masking any original specific focus. At this point the person has constant back problems and pain. In order to interrupt this pain cycle a very useful way is by general relxation facilitated by specific EMG relaxation of the abdominal and back musculature. When accomplished successfully the patient feels relief of the pain and can maintain both discrimination of muscle and lowering of muscle tension in the affected area. EEG alpha training for pain control is sometimes effective. The patient may be able to clear his mind of the obsessive thoughts of the pain and discomfort, and learning to "let go" in the face of the first signs of discomfort rather than brace and obsess.

Potential Applications:

Epilepsy: Recent advances in the research involving seizure disorders have resulted in clinically useful and utilizable methods for biofeedback training. Enhancement of sensorimotor rhythms (SMR), and a subdominant EEG rhythm of 12-14 Hz, fed back from the sensorimotor cortex has been shown to reduce seizure activity in some individuals.(Sterman, 1977).

Hyperkinesis: Frequently misdiagnosed and not clearly understood from a causal standpoint, hyperactive behavior in children has been studied as a possible biofeedback application. Working variously with EEG, EMG, GSR and TEMP, the child is taught greater self-control through relaxation and lowering of arousal levels.

"In some medical conditions, biofeedback represents a behavioral sympathectomy... achieving the effect without a knife and the negative side effects."

CASE STUDIES: A Sample of the Variety
of Biofeedback Clients and Problems

A Junior Executive with Phone Stuttering.
A five-year old Girl with Asthma.
A Handwashing Compulsion in a Housewife.
A Movie Producer with dismemberment Obsessions.
An Oriental Man with a severe Facial Tic.
The Cosmetologist with Hyperhydrosis.
The Blushing Farmboy from the Valley.
The Balding Female with Hair-pulling Compulsion
The Migraine sufferer who left Her Husband.
A Hemophiliac with a Needle Phobia
The Classical Guitarist who had Finger Spasms.
The Psychotic Emphesema Patient who Smoked.
The Travel Phobic who rode in the Back Seat
of the Car while his Wife Drove.
The Honor Student with Reading Disorder.
The Nauseated Millionnaire.
The Three Brothers who Couldn't Pay Attention.
The Young Woman with Chronic Constipation.
The Insomniac Cardiologist.
An Artist who Wanted to Enhance Creativity.
The Low Back Pain Patient with Anal Tension.
The Skier Who Learned to Warm His Hands.
A Case of Impotence after Masters & Johnson.
The Jr.High Teacher with Tension Headaches.
The Training Analyst with a Broken Heart.
The Girl with one Lung who Had Tension on Exhale.
The Lawyer with Voice Tension.

Chapter VI

DEVELOPMENT OF PRACTICE OR CLINIC

Independent Practice

- Alone
- With Assistant
- In Group

Clinic Practice

- Hospital
- Multidisciplinary Clinic

Setting

Staff

Organization/Administration

Referrals

Fees/Billing

Therapist Reimbursement

Insurance

Malpractice Coverage

Record Keeping

Professional Societies

- BSA
- BSC
- Training
- Certification

Legislation

Ethics/Publicity

This chapter outlines the practical issues and problems of setting up a practice or organizing a clinic with biofeedback as a major focus. While the details may vary by the discipline, interests, and area of the country, the general guidelines should offer a starting point for current answers to nuts-and-bolts questions such as "How is billing done?" and "What are the ways of approaching biofeedback treatment?".

Independent Practice:

The difficulty in practicing alone is quickly seen when one considers the skill, time, and expense involved in comprehensive biofeedback work. The therapist is placed in a position of the renaissance man who must be conversant with medicine, psychology, behavior modification, electronics, and physical therapy. Few professionals have had the breadth of training to deal with all of the issues arising in a typical week. Not only does the question arise: "Where shall I place the electrodes properly for this problem?" but also, "What is making the meter swing wildly in this instance?" or "Exactly what are the effects of all these medications my client is taking?"; "Does this patient exhibit psychotic dynamics?";"There seems to be no evidence of shaping occuring in the learning curve"; "How can I best reinforce and facilitate generalization in this training?". Without knowledge or consultation concerning these questions, the clinician faces one frustration after the other, despite the expensive and elaborate equipment.

The second issue, that of time expenditure, is another factor that must be considered in independent practice. Biofeedback itself does not decrease the involvement, complexity, and comprehensiveness

of contact with the client; if anything, it adds to it. Although the total treatment course may be reduced considerably by the introduction of biofeedback instruments and techniques, the time the therapist puts into the process is not lessened. Careful history taking, development of rapport, and enhancement of motivation all remain as essential elements of biofeedback treatment as in any other treatment.

Finally, the cost of the biofeedback instruments, especially if only utilized by one therapist, is added to whatever equipment typically required for that particular practice. It is inconceivable that any complete biofeedback service could be offered with only a few hundred dollars' investment; more accurately, several thousand dollars are modal. The rapid obsolescence of the equipment should also be considered as one makes the investment.

With Assistant: One potential solution to these issues is the addition of an assistant. In relatively routine cases with limited complications, the addition of a well-trained assistant increases efficiency. However, the assistant usually has had less training than the clinician, and will require supervision, and while the therapist's time is reduced, the salary of the assistant does increase overall costs. (Fuller, 1977c).

Group Practice: A group practice, if not in name only, begins to offer a potential for diverse skills and comprehensive coverage as well as sharing the purchase and maintenance of equipment. The larger the practice, the more efficiently budgeted is the secretarial and technical support. Group practices are rarely composed of mixed professionals,

representing a less desirable arrangement than would be possible if quite different sources of expertise were available to each other.

Hospital Clinic Practice:

The hospital setting could provide for the availability and comprehensiveness of skill, time and funds. To the extent to which the facility is a supportive and cooperative one, the biofeedback methods will flourish. Unfortunately, hospitals also frequently present a sterile, incompatible setting, often characterized by petty departmental jealousy and inflexible adherence to an orthodox view of treatment. To that extent, the biofeedback use may become mechanized, questioned, or cost-accounted. On the occasions where biofeedback is respected, supported and allowed to promote a quite different view of health maintenance, this setting will undoubtedly nurture its use.

Multidisciplinary Facility: My bias, arising out of my experience in hospitals, private practice and group practice settings, is toward the multidisciplinary facility. Here is the potential for maintenance of a compatible attitude, cooperation, appropriate selection of experts, and primary focus on biofeedback as a significant treatment modality. Thus, professionals of different backgrounds and areas of expertise can be brought together, and participate in a team effort, share experience in staff meetings, and provide mutual consultation on biofeedback appropriate cases.

Due to the diversity of disorders and conditions for which biofeedback is utilized as a treatment modality, a multidisciplinary approach is considered to be of substantial importance. To facilitate an interchange of information from professionals in

a variety of fields, the Institute conducts staff meetings every week which devote time to problem-solving, case presentations, etc. These meetings are considered quite stimulating and a source of fresh ideas and treatment approaches. In addition, staff members frequently consult with each other between sessions. At times, two or more staff members will consult conjointly with a patient during the course of a therapy session. This multiple consultation not only augments the staff members' treatment knowledge, but also fortifies the patient's confidence that everything possible is being done to facilitate the amelioration of his disorder. (Fuller, 1976 d)

The Biofeedback Institute of San Francisco, A Psychological Corporation, is an example of a private, multidisciplinary, comprehensive outpatient facility with four major functions:

1) The application of biofeedback as well as traditional techniques to psychophysiological, psychological, and special disorders. Biofeedback procedures are integrated with psychotherapy, behavioral techniques, physical therapy, hypnosis, and other methods.

2) The training of professionals in biofeedback. As an approved training program of the Biofeedback Society of California, it has courses designed to meet the certification requirements of the BSC. In addition, the Institute has continuing education seminars and conferences, and out-of-state workshops for comprehensive biofeedback training.

3) Consultation with agencies, stress management programs for businesses and corporations, and program development for organizations. A wide variety of special programs from public education to specific biofeedback projects with skiers, executives, and air traffic controllers are available.

4) Research in clinical applications of biofeedback, outcome and approaches and an information resource center for biofeedback literature and research is maintained. Communication with major laboratories and biofeedback clinics results in prints and articles of virtually all the work available in the field. Clinical research, funded solely by the Institute, on the efficacy (effectiveness) of biofeedback training is conducted on a large scale (see Research Chapter).

Setting:

Occupying an attractive Victorian office building in a professional area located near several hospitals in San Francisco, the Institute serves clients in the Metropolitan Bay Area and professionals in western United States. It has expanded to include a total of six therapy offices, a conference room, administrative and waiting areas, two restrooms, staff meeting and kitchen facilities. All offices have windows looking out onto pleasant green gardens, trees or decks. The furnishings, while professional, are comfortable and colorful. Accents of victorian furnishings such as lamps, psychiatrist cut-velvet-fainting couch, and stained glass windows provide a more attractive, relaxing atmosphere than the typical efficient office atmosphere.

The basic essentials of chairs and facilities include: multi-position recliners, stacking chairs for meetings, storage areas for equipment and supplies , storable chairs (with headrests) for group relaxation and conferences, and variable lighting. Quiet, soundproofed rooms and electrical shielding(where necessary) are essentials. It has been very convenient and useful to have rolling chairs or carts that can be brought in front of the training chair and adjusted to eye level. Temperature stability and freedom from drafts is crucial, especially where TEMP training is done. Thermometers that give indoor-oudoor temperatures are beneficial. Multiple outlets and provisions for audio and video tape equipment and cameras prove valuable both for use in treatment and for observation during training programs.

Staff:

Stemming from the concept of bringing together professionals of differing backgrounds and areas of expertise, the Insitute has a core group of twelve licensed professionals, five professional consultants, three biofeedback technicians, an electronics engineer and three administrative staff. The practitioners include four Clinical Psychologists, three Psychological Assistants, two Psychiatrists, a Physician, a Social Worker, a Physical Therapist and a Speech Pathologist. These professionals are affilitated with hospitals, agencies and universities in addition to their clinical biofeedback work at the Institute.

The specialized backgrounds of each professional provides the following emphasis in terms of clinical expertise.

Clinical Psychologist: Has knowledge of the behavioral and dynamic issues of personality, psychotherapy, and psychological assessment. In addition, he or she frequently provides expertise in specialty areas such as learning theory, hypnosis, physiology, research, and behavioral psychotherapeutic techniques. The Psychological Assistant is licensed by the State to perform all the duties of the Psychologist under the Clinical Psychologist's licensure and supervision. Behavior modification specialists introduce skills in accelerated approaches to behavioral treatments, optimization of learning curves (especially when training plateaus occur), and problems with extinction and generalization in learning.

Physician/Psychiatrist: In addition to extensive skills in medical diagnosis and the dynamics of treatment, they have a comprehensive understanding of the relationship between medication and diet,

psychosomatic and physical factors, and severe psychological disorders. The psychiatrist adds to this further training in psychodynamics, psychotherapy techniques and diagnosis.

Physical Therapist: Provides expertise in the area of muscle groups, location of tension points on the body, trigger points (areas sensitive to external pressure which, when pressed, result in a release of tension), and standard muscle retraining procedures. In addition, they have specialized knowledge of diagnositic procedures for conditions such as poor gait, or unusual muscle movement patterns.

Social Worker: In addition to possessing therapeutic skills, the social worker is often best qualified to work with integrated social and psychological elements of the treatment process. Such an approach might be utilized in a variety of disparate cases ranging from muscle rehabilitation (where the patient may be simultaneously involved in a sheltered workshop), to cases of children from halfway houses or children's homes, to drug addiction cases where biofeedback training program is integrated with drug abuse programs in the community.

Speech Pathologist: Has training in anatomy and pathology of the vocal and speech apparatus. This specialist is capable of focal therapy for vocal tension, aphasia, and other speech disorders. Using biofeedback instrumentation in conjunction with respiration phonation, resonance, and articulation exercises and training, the dysfluent speech can be significantly reduced or eliminated.

Biofeedback Technician: The use of a biofeedback assistant is considered desirable in cases where routine training with a psychologist or psychiatrist over a given period of time would be economically prohibitive for the patient. In such cases, the direct training is administered by the technician under the supervision of the primary therapist. Biofeedback technicians can be used in personal growth exploration, where there is minimal involvement of medical or psychological issues.

In general, the Institute has adopted an exploratory, eclectic approach to therapeutic methodology and training protocol. The Institute is generally oriented toward short-term rather than long-term therapy, with an average of ten treatment sessions per patient.

Due to the broad range of disorders and conditions treated at the Institute, as well as the diverse professional backgrounds of the staff members, a substantial variety of treatment approaches and therapeutic techniques are utilized. These are carefully selected and tailored to the specific circumstances of the patient. Examples of therapeutic methodologies frequently employed by therapists include progressive relaxation techniques, autogenic training, "negative practice" techniques, insight-oriented psychotherapeutic techniques, dietary changes, muscular retraining and conditioning procedures, etc. Of special interest is the Institute's use of systematic desensitization procedures, "negative practice" techniques, videotape feedback, and in vivo desensitization and generalization procedures in the context of a biofeedback program.

Organization and Administration:

Responsibility for the maintenance and improvement of the programs and procedures at the Institute is handled by various persons. The Clinical Director oversees the operation of the Institute and establishes major policy decisions. He is in close working relationship with the staff, since decisions affecting clients and therapists are raised in the weekly staff meetings or discussed with the appropriate person.

Responsibility for treatment, decisions as to the most appropriate treatment modality, termination, and contract-setting, is exclusively that of the therapist (licensed professional). Psychological Assistants, while licensed to perform the services of a psychologist, work under their supervisor who is responsible for the treatment decisions. Technicians also work under the supervision of a licensed professional in performing direct biofeedback and relaxation training.

The legal status of the therapists is that of an Independent Contractor, rather than employees. The Institute, as an entity, provides facilities, administrative services, supplies, and the setting. The therapists, as Independent Contractors, have primary discretion in their clinical practice within their area of expertise. The ample opportunity for expansion of one's professional skills is made available in the weekly staff meetings, in frequent contact with the other therapists, and by the extensive collection of research articles and literature maintained by the Institute.

The availability of professionals of various expertise encourages consultation on treatment issues. Medical, psychological, physical therapy or other issues are frequently raised in the group

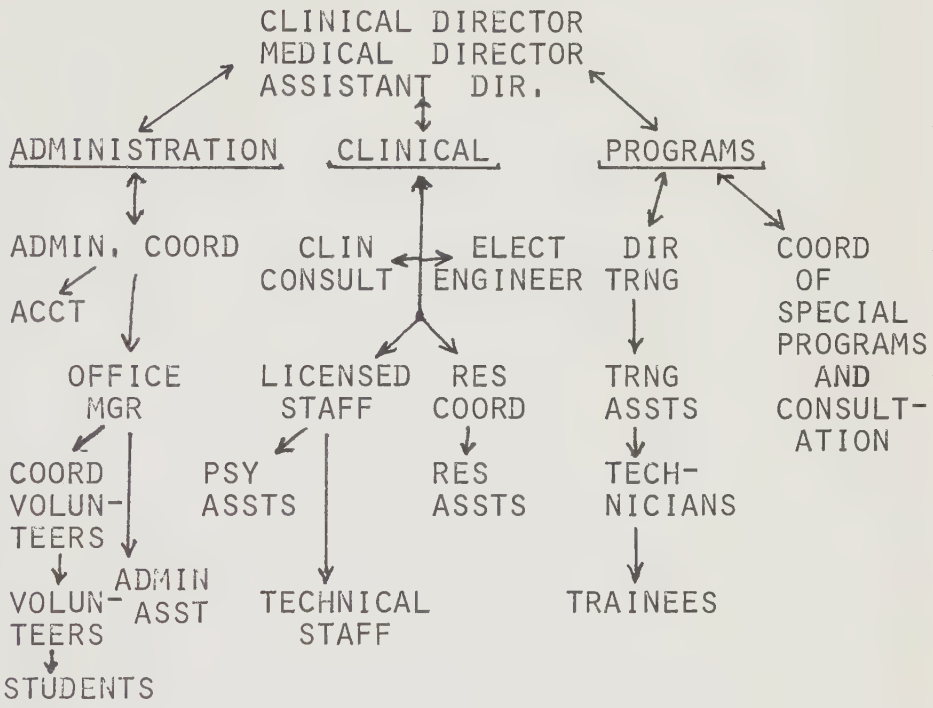
meeting and on private consultation with the Clinical Director, physicians or appropriate professionals. Several consultants also provide their expertise as requested.

Administrative procedures are handled by the Administrative Coordinator, Office Manager, Administrative Assistant, and bookkeeper. There are no receptionists per se. The diversity of the services provided, and the rapid development of the biofeedback field,have required that the person(s) who answer phone calls and greet patients and professionals be sophisticated in the services and in biofeedback generally. A portion of each staff meeting is usually spent reviewing administrative issues (e.g. insurance questions, new session records, purchase of new equipment, billing policies, and furnishings). Major policy decisions are made jointly by the Administrative Coordinator and the Clinical Director.

Responsibility for client services (billing, insurance forms, appointments, test administration and scoring, etc.), public relations (brochure, newsletters, public education ,etc.), and professional services (announcement of programs, services, etc), are divided among the administrative staff. Volunteers assist in some of the more routine tasks (typing library cards, mailings, etc.).

Professional training programs and other special programs are the responsibility of the Training Director or the Coordinator of the special program. Major decisions are made jointly with the Clinical Director. The administrative staff assists in typing, mailings, and other office tasks. The professional staff is an active part of all programs, both in the formative stage and in the carrying-out of the program.

BIOFEEDBACK INSTITUTE ORGANIZATIONAL CHART



Referrals:

Referrals are made by physicians and other professionals in the community, health and rehabilitation agencies, by former or current clients and others. Additionally, some clients learn of the Institute as a result of lectures to professional groups, classes, articles and television programs and listings in the telephone directory. Although no advertising is done, a fact sheet on the Institute's functions and services is available on request.

At the outset, most referrals came from professionals (primarily physicians). Each year an increasing percentage come from former clients who have conveyed their successful outcomes to friends.

Fees and Billing:

The Institute's sessions are time based at fifty-minute hour. This time unit is used for three reasons: it has precedence as a customary unit; allows for enough time for most biofeedback training protocols , as well as time to discuss relevant issues, and to complete the billing and appointment setting. This allows maximum utilization of equipment and space. It has been our experience that 30 minute appointments tend to last 40-50 minutes in actuality, since 30 minutes is rarely enough time to complete the biofeedback process and allows little "talk-time".

There is a base fee for the 50-minute session, applicable to all clients, unless a reduction is made by the therapist for special financial reasons. Biofeedback and relaxation groups are billed at a separate rate.

Billing is done by a single-entry system. The client typically pays the fee at the end of each session. The therapist (not an administrative person) typically completes the statement stub, which also shows receipt (credits), service provided and charge, and next appointment time. We have found that collection of fees is better maintained where clients deal directly with the therapist with whom they established the fee contract,(than with a secretary) at the time of the visit. Payments are made directly to The Biofeedback Institute. Statements are sent monthly for outstanding accounts, and each therapist receives a list of clients with outstanding accounts. Difficulties in billing also present treatment issues.

Clients understand that they are responsible for the fee. If third-party payers are involved, the client handles the fee in full and is reimbursed by the insurance carrier. (See Appendix for forms).

Therapist Reimbursement:

Therapists are reimbursed on a client-hour basis in accordance with a matrix. This matrix bases reimbursement for contract services on the number of client hours seen, years of affilitaiton with the Institute, and average fee obtained. It has been found to be an effective reinforcing structure.

The concept of a mixed professional group has presented some problems in terms of billing, health insurance, legal considerations, etc. Frequently, a heterogeneous professional group has difficulty incorporating under the same umbrella. In addition, it is required to obtain different types of liability

insurance for individual staff members. Moreover, in terms of health insurance, the process of billing patients becomes somewhat complicated. For example, all therapists are reimbursed by the Institute on the same matrix, regardless of discipline. But a third-party carrier will often have a different rate of reimbursement for EMG training administered by a physical therapist than the same kind of work by a psychotherapist.

Insurance:

The handling of third party payments is an unresolved and many-sided issue. Depending on ones philosophy of practice and/or willingness to take the time necessary to get reimbursement on behalf of the client, several different approaches can be taken. One major approach (and the one we have been taking) is that of ascertaining that biofeedback is not a separate profession but is instead a modality within a profession(s). Thus, as used by a psychologist, biofeedback is one of many different modalities used in psychotherapy in addition to talking, listening, hypnosis, pscyhoanalytic interpretation, transactional analysis, behavioral methods,etc. Since what is done in the course of a session is not entirely separable or capable of being parcelled out, it is considered in the general rubric of psychotherapy. As used by a physical therapist, the procedures are included as part of the process of physical therapy. Thus, biofeedback is one of several possible modalities. The same is true of medicine and so on. In this case, the matter of third party billing is very clear-cut; the licensed professional who is trained and competent in the use of biofeedback , and who is treating a problem within his expertise, seeks reimbursement in the particular area of therapy in which he is licensed and in which biofeedback is used as a procedure.

As for the diagnosis or category of treatment, in the case of psychotherapy, typically a neuroses such as anxiety reaction or phobic reaction poses little difficulty. In the more physically symptomatic disorders, the diagnostic category of psychophysiological reaction is appropriate for such disorders as:tension headache (musculoskeletal); colitis (gastrointestinal); migraine headache (cardiovascular); and asthma (respiratory) conditions. The physical therapist refers to neuromuscular reeducation for stroke, paraplegia, torticollis, etc. In the case of general medicine which is technically more diagnostic and leaves treatment to "paramedical personnel", the billing is for an extended office visit where biofeedback training is done for an extensive period of time (e.g.½hour or full hour).

A different view is to see biofeedback as a separate billing category in which "biofeedback" is the treatment. Some insurance companies may consider the claim psychiatric service and therfore payable only to extent that psychiatric services are covered. Others may cover the service but ultimately have difficulty in ascertaining who is an eligible provider. Finally, some carriers are reimbursing for biofeedback treatment for only certain specified conditions. Possibily arising from a stance that biofeedback in general is experimental, these conditions (such as torticollis, hypertension, migraine and tension headache) would be a benefit, but other conditions not covered until "proven" to be treatable.

The use of technicians in biofeedback is a problem for insurance coverage as well as of malpractice. The therapist must interpret the meaning of "provider". Some cases are clear-cut; for example, MediCal in California requires that no one but the

provider of the services who actually saw the patient, administered the services , and signed the claim form may be reimbursed. Thus, technicians cannot administer services. Some insurance forms may not ask for specification as to whether the services were provided directly, and may assume that the provider who signed the claim is directly performing the services. Other carriers may see the use of assistants as common practice.

Committees of the Biofeedback Society of America and the Biofeedback Society of California are attempting to obtain information pertaining to the coverage of biofeedback services by the insurance industry. The Society would like to provide clarification and input into the determination of policy on biofeedback treatment. As members inform the committees about their attitudes and experiences, a position statement will be developed and guidelines formed.

Malpractice Coverage:

Biofeedback use is generally covered by the physician's malpractice insurance. Many professional group policies are available and will include coverage for biofeedback use (usually provided there is no penetration of the skin). Nonetheless, it is important to be aware of the precautions and contra-indications; cautious as to the treatment services provided; conservative as to the results claimed, having adequate consultation and/or limitation on medically-related or high-risk conditions; and having expert legal advice in the development of a practice.

Recordkeeping:

The essentials of good records for biofeedback training include the initial psychological tests, information about the person and their symptom(s) and the individual session records and initial baselines. It is important to add a final visit indication of the outcome of treatment--from the patient's view, the therapist's view, test and baseline changes, and adequate follow-up.

While the information collected is dependent on the style, training and interests of the therapist, the basic information that should always be obtained is:

Chief complaint/presenting problem
Frequency and severity of problem(s)
Length of time they have had the problem(s)
Professionals previously consulted about it
Other treatment received and effectiveness
How they happened to contact you
Medication taken
How they feel about their life generally

During treatment the following is obtained:

Goals or plan
Contract for treatment
Instrument baselines and changes
Percent time talking, or instrument training, or monitoring
Patient's evaluation of the severity of their problem(s), frequency, and his or her general state of well-being.

See Appendix for recordkeeping forms and summaries.

Professional Societies:

Biofeedback Society of America: Beginning originally as the Biofeedback Research Society, and formed primarily of researchers interested in biofeedback who came from such diverse backgrounds as sleep, pharmacology, and neurobiology, this national society has grown into two divisions:experimental and applied. Currently more than half of the membership is primarily engaged in applied work.

In part through the pressure of its own membership, and in part at the prodding of Federal Agencies (e.g. FDA) to have "biofeedback police its own house, or we'll do it" , the Society has been forced into a position of struggling with issues such as malpractice, instrumentation standards, ethics, insurance, and contraindicaions.

Psychologists and other non-medical professionals who use biofeedback in practice are faced with medical-physical problems in a new area, sometimes called "behavioral medicine". They are confronted with professional issues that raise confusion and are finding that the previous models and treatment standards do not work well. As an illustrative question: How is responsibility for treatment determined for patients referred by physicians to psychologists for biofeedback treatment of functional medical disorders and stress-related psychosomatic illnesses? (Strobel, Schwartz; BSA meeting Orlando, 1977).

Annual meetings are held for presentation of research papers, booths, clinical papers and panels, instrumentation displays, and business meetings. It is an excellent opportunity for expansion of one's understanding of the state of the art. Professionals and researchers in biofeedback are advised to become members of the national society.

STATE SOCIETIES (1977)

ARIZONA

CALIFORNIA

COLORADO

FLORIDA

HAWAII

ILLINOIS

INDIANA

KANSAS

LOUISIANA

MICHIGAN

MINNESOTA

NEW MEXICO

NEW YORK

OHIO

OKLAHOMA

TENNESSEE

VERMONT

Biofeedback Society of California (BSC):

BSC began as as idea in 1975, and quickly formed as an amalgamation of several splinter groups into one representative society. With Ed Wortz, Ph.D. as the first elected president, the Board members spent long hours in meetings in northern and southern California, attempting to develop ideas, disseminate information, and find solutions to difficult problems. The society began as a professional organization dealing with the protection of the public and problems of the professional in clinical application of biofeedback. It has continued this clinical approach.

The 1976 year (George Fuller, Ph.D., President) was characterized by an attempt to put into practice many of the ideas developed. A key issue has been the competency of persons who use biofeedback for a fee. In 1976, training and certification programs for professionals and assistants were begun. Several facilities were approved for meeting the requirements for basic training in biofeedback, and an examination procedure was established to determine minimum competency in the use of biofeedback.

Following the implementation of these programs there has been an adjustment and refinement of the working procedures in 1977, under Mel Werbach, M.D. . The Board of Directors meet discuss reports of the committees and relevant issues. An annual meeting is held, alternating between northern and southern California, where panels, papers, and displays are presented to membership and public.

Other states have developed professional societies since the formulation of BSC. (See Appendix).

Training: A critical issue in the development and success of biofeedback in the treatment of psychophysiological and other disorders lies in the training of the professional or assistant who administers the services. It has been only very recently that any formal programs were developed for providing basic training in the use of biofeedback.

The California Society,BSC, approved several training programs in California which provide the following : (for 1976-77)

Didactic Instruction: Basic information on biofeedback, including theory, use of instruments, research, clinical applications and procedures, relaxation techniques,etc. (20 hours required)

Case studies: Focus on syndromes and clinical cases. Procedures, problems, contraindications, homework, ethics, placebo effects, etc. (10 hours)

Personal training: Personal biofeedback experience with instruments, at least four different types. (10 hours with certified trainer; 10 hours additional).

Clinical Experience: Experience working with others in a clinical setting. Sessions are discussed with supervisor. (20 hours)

Supervision: Supervision of clinical experience and other matters of concern to program participants. (5 hours individual; 5 hours group supervision).

BSC is attempting to refine the requirements for entry to a program (prior experience), and the total hours in each area required as a minimum.

Certification: Several states have formulated or are developing standards for certification. Certification is not to be confused with licensure by the State. The intent of certification is to find a minimal level of competence that could be testable and recognized.It is not a license.

The BSC certification program, as it stands now, evaluates the person's ability to apply biofeedback in some responsible and meaningful way within their professional area, or under the supervision of a professional (as biofeedback assistant). The intent is not to test someone's ability in physical therapy, or medicine, or psychology, etc., but to test basic understanding of use of biofeedback as a modality.

BSC has established oral and written examinations which may be taken separately. There is a simple pass/fail system for each portion of the examination. Applications to take the examinations will be accepted when the applicant demonstrates that they have met the training requirements, either through a formal program or by other experience, (equivalent training).

In addition to protection of the public, the purpose of developing certification procedures is to provide adequate and effective standards for anticipated State regulation of biofeedback.

Certification should not be regarded as a "pseudo-license" to be misused by currently non-licensed individuals without extensive professional training in order to practice autonomously on a fee-for-service basis.

Legislation:

There are typically no laws governing the use of biofeedback per se. Most states do, however, license various professions (medicine, psychology, physical therapy, etc.). Some professions have moved to have biofeedback included in their current licensure laws. For example, in California, as of January 1, 1977, the Psychology Licensure Act includes the use of biofeedback. One important effect of this amendment is that most national legislation, including the Medical Devices Act, defines a user as a licensed provider, thus leaving the decision up to the states to determine which professions are covered. In order to clarify whether or not a professional is able, under the law, to incorporate the use of biofeedback devices into their practice, it would appear that each profession, in each state, must include biofeedback into the current licensure laws.

If the use of biofeedback is seen by the State to be part of the practice of various professions, use of biofeedback by a non-licensed individual in the treatment of a disorder could make that individual subject to legal action for practicing (medicine, psychology, etc.) without a license. As a hypothetical example of the legal difficulties that could be forthcoming with the non-licensed use of biofeedback, is the following:

> Joe Brown , after attending seminars in biofeedback and extensive reading, buys an EMG instrument. He sets up a small office and accepts a fee for doing EMG biofeedback. Mr. Smith comes to him with colitis, and Joe Brown suggests that biofeedback is helpful in that colitis is a tension-related disorder. Mr. Smith subsequently dies of colon obstruction; the family brings charges against Joe Brown. A determination is made that Brown

was treating Smith's colitis, accepting a fee for the service, and practicing medicine without a license. He is punished as proscribed by the law.

When the states move to regulate the use of biofeedback instrumentation they will, in all likelihood, look toward guidelines currently enforced by those who are most involved in the field, i.e. membership of state biofeedback societies. One very positive outcome of this manner of approach is that those most knowledgeable in biofeedback practice have the responsibility for formulating the procedures, rather than legislators or administrators who may not fully understand the implications of arbitrary decisions regarding biofeedback use.

Medical Devices Act: The Medical Devices Amendments of 1976 became law on May 29, 1976. As Public Law 94-295, it amended the Federal Food, Drug and Cosmetic Act (21 USC 201). Included are biofeedback and other devices that have been considered behavioral or psychological devices. The definition of a medical device in the new law is extremely inclusive: "Any instrument or apparatus that is intended to affect the structure or any function of the body of man or other animals." While the law is primarily concerned with the safety and effectiveness of medical devices, it may have considerable impact on manufacturers, psychological practice and research.

Ethical Principles for Biofeedback Practitioners and Researchers: (Prepared by E.Peper, Ethics Committee, B.S.C. 1976)

1. The biofeedback practitioner should abide by the spirit of the various professional codes of conduct, such as those of the APA, APTA, etc.

2. The biofeedback practitioner or researcher should guarantee that the results of research are confidential. Plans for protecting confidentiality should be discussed with the subjects, and subjects should approve published data before publication.

3. Biofeedback techniques and instruction should be applied only within the practitioner's specific area of competence (e.g. counseling psychology, physical therapy, education, growth, wellness,etc.)

4.Biofeedback practitioners should avoid all claims as to the efficacy of biofeedback training or techniques that have not been proven.

5. The biofeedback practitioner should explain to the subject or client all research procedures and should obtain from the subject informed consent to participate in the research.

Biofeedback is a new approach, often incorporated with other techniques, therapies, or education. In many cases, these biofeedback applications have not been independently proven. These techniques amplify the psychophysiology of the body/mind. They should be applied in the spirit of true experimentation, which implies informed consent for all clinical or educational research.

CHAPTER VII
REASEARCH

Evaluation of Treatment Effectiveness

Outcome Measures for Clinical Biofeedback

Evaluating Biofeedback Effectiveness (A Proposed Clinical Research Design)

Summary of Evaluation of Clinical Biofeedback; Preliminary Descriptive Data

Conclusion

Evaluation of Treatment Effectiveness:

How effective is clinical biofeedback (as opposed to that applied under rigorously controlled conditions)? Or, more realistically, is biofeedback, as practiced in this particular type of clinic or center, effective? That is, does it or does it not effect reductions in symptom frequency or severity? Does it or does it not help clients deal more appropriately with stress? Is it lasting and able to generalize to the many traumas of everyday life? How often, with which instruments and procedures, and under what conditions does learning take place best? How can the therapist determine these questions in formulating a treatment plan?

The evaluation of the effects of treatment usually involves many factors such as: selection of subjects, selection of treatments, assignment of subjects to treatments, selection of predictor variables and analysis of the data. Another factor, the selection of outcome measures, is also of considerable importance and of particular interest in this study. Outcome measures, of course, necessarily involve post-treatment measurements or observations, but they usually consist of change scores from before to after treatment. Such pre-post measures have some disadvantages. Learning effects from one administration to the next, placebo-expectancy effects and significant intervening events, for instance, might influence the comparisons and make interpretations of pre-post measures very difficult (for greater expansion on such problems see Goldstein, Heller, & Sechrest, 1966, and Underwood, 1957). Notwithstanding these limitations, many of which can be controlled and minimized to some extent,

the before and after measures can be considered reasonable, useful tools with which to assess outcome.

Waskow and Parloff (1975) point out the importance in outcome evaluation of obtaining three different kinds of measures: individualized measures, those relevant to particular psychiatric subpopulations and more general "across-the-board-measures." The use of such diverse measures ordinarily promotes greater applicability, comparability and specificity of the obtained results. In addition, it is considered essential to include outcome measures from as many perspectives as possible: the client's, the therapist's, an independent evaluator's, and from that of a relevant person in the client's life. Past research has indicated that measures taken from these different viewpoints reflect independent or separate aspects of change (Waskow & Parloff, 1975), and are therefore all important in the evaluation of treatment outcomes.

Outcome Measures for Clinical Biofeedback:

In an attempt to satisfy the criteria set forth by Waskow and Parloff (1975), while at the same time considering the unique features of clinical biofeedback, one might consider the items described below as reasonable outcome measures in evaluating biofeedback treatments.

Perhaps the single most relevant measure involves the degree of relief from the primary condition for which treatment is sought. This can be accomplished by obtaining a description and brief history of the complaint(s), a measure of frequency and a rating on a forced choice rating scale/questionnaire completed by the client. In addition, the client can respond to a brief

symptom checklist which provides information concerning the extent and variety of the client's psychosomatic complaints. Medication changes are also important in assessing treatment effectiveness. Thus, the client should be asked to identify the medications being taken and their dosage, both before treatment begins and again following termination. These three measures, change in frequency and/or severity of main problem(s), change in number of symptoms checked and change in medication required, have two important advantages.

First, since biofeedback is essentially a psychophysiological technique, and its main benefits at this time appear to be in the treatment of somatic and stress-related disorders, measures relating to observable symptoms and drug use are extremely pertinent. Secondly, these measures provide individualized information about each client. Aside from their value as outcome measures, such indvidually tailored measures serve as a framework for both therapist and client in which to specify particular treatment goals.

Another instrument which satisfies the criterion of relevance to biofeedback treatments is the Fuller Biofeedback Profile (FBP), a new tool for the physiological differentiation of clients. This Profile attempts to integrate the patterning of a person's physiological responsivenesss rather than just recording response levels on various modalities. It juxtaposes the client's mean response level, mean response variability and mean bivalent response change on four different biofeedback modalities (namely electroencephalographic (EEG), electromyographic (EMG), electrodermal (GSR) and peripheral skin

temperature (TEMP) responses) as well as other possible measures such as mean level of diastolic and systolic blood pressures or heart rate. The FBP is constructed such that a pattern appearing largely in the lower third of the profile reflects an individual in a relatively stable, unstressed or relaxed condition whose physiological response changes during observation were in the direction of greater relaxation. On the other hand, an elevated pattern suggests a high degree of stress, significant variability of responses and a directional change in responsiveness during observation, generally away from relaxation and toward greater stress.

Changes on the FBP from before to after biofeedback treatment would be expected since individuals are usually trained in the control of physiological responses. Such changes represent a meaningful way to describe the benefits of biofeedback treatment and are, therefore, considered a reasonable measure of outcome.

Global or "across-the-board" assessments are also essential. They make possible comparisons between biofeedback treatment outcomes and those resulting from other treatments. Furthermore, research has suggested that more global ratings prove to be more sensitive to differential treatment effects than multiple-item ratings (McNair, 1973) or single dimension measures of psychopathology (McGlashan, 1973). One such measure consists of letting both the therapist and the client rate the success of treatment. While not the most accurate measures of outcome, they do provide information regarding outcome from separate viewpoints. For greater objectivity, the comparison of a rating made by an independent evaluator before treatment with

another rating made after treatment is needed. For this purpose, the Global Assessment Scale (GAS) developed by Endicott, Spitzer, Fleiss & Cohen (1976) seems particularly appropriate. Originally based on the Health-Sickness Rating Scale (Luborsky & Bachrach, 1974), the GAS is a single rating scale with value ranges from one (1 = sickest) to one hundred (100 = healthiest), and divided into ten equal intervals. The characteristics which define the ten-point intervals comprise the scale. Since this instrument has been studied and found useful in different clinical settings and with different psychiatric populations (Endictott et al, 1976), the GAS should prove to be as adequate in assessing biofeedback clients as it is in assessing clients seen in other clinics or treatment settings.

Another individualized measure, but one that can also distinguish between different client subpopulations, is the Minnesota Multiphasic Personality Inventory (MMPI). Its value lies in its ability to tap various dimensions of psychological disturbance. Furthermore, it should be included on the basis of its wide usage in research, thus providing greater applicability and comparability to the results obtained. Though widely criticized, as pointed out by both Gynther (1972)and Rodgers (1972), it remains a useful tool for assessing changes occurring with treatment (Waskow & Parloff, 1975). The Rotter Internal/External Locus-of-Control Test and Life Change Inventory (Holmes & Rahe,1967) are also useful assessment devices.

On the whole, these items have been selected as the best available outcome measures for biofeedback treatment on the following bases: they

provide relatively complete information and information which is relevant with respect to the client population seen in biofeedback clinics, they are low in cost, readily available, easily scored and quantified, relatively inoffensive to clients and therapists, and their administration does not require excessive amounts of time.

While experimental biofeedback can be described as essentially unitary in nature, the clinical practice of biofeedback is a substantially composite treatment approach. Little applied research has been conducted on the use of biofeedback in the treatment oriented clinic, and in light of this fact, the ongoing Research Programs of the Biofeedback Institute of San Francisco, evaluates treatment outcome for all of its activities. The Biofeedback Institute of San Francisco is one of the earliest clinics to be established, and its evaluation program will also be used in clinical investigations of the effects on outcome of different types of therapists, therapist behaviors and treatments or treatment combinations. This research will seek to match different client subgroups with those therapists and/or treatments which effect the largest positive changes in each subgroup. The outcome measures described above must reflect differences between a group of untreated clients who are seeking treatment and a group of treated clients.

Although the researcher is interested in whether the control that is achieved in autonomic conditioning is clearly free of the influences in voluntary activity, the clinician is not as interested in the purity of the operant means of control. The issue is more the control, rather

than the means of control. The primary concern in clinical studies is that the variables in question can be controlled through biofeedback. The reinforcement is not always well defined and may be to a great extent the client's own satisfaction or success and the therapist's approval of his success. Thus, the relationship is an important variable.

There are several research paradigms that provide information concerning therapeutic outcome. Blanchard and Young (1974) discuss five experimental procedures for biofeedback studies:
Anecdotal Case Report without systematic data or control procedures, but description of pre and post-treatment symptoms. It is useful, although few data about treatment effectiveness are obtained.
Systematic Case Study (A-B design) includes measurement of response over pre (baseline) and during treatment conditions. Change in symptoms can give interpretable results, especially if adequate baseline is obtained or if several patients are given a similar treatment and show similar changes. The combination can provide strong evidence of the efficacy of a treatment.
Controlled Single Subject Experiment (A-B-A design) uses data collected across at least three conditions: baseline (pre-treatment), treatment intervention and a return to baseline measurement (treatment reversal) condition. In ethical clinical work, this should be followed by a second treatment condition if improvement were observed.
Single Group Outcome Study in which several subjects are observed on the same variables during pre and post-treatment conditions. Changes in treatment period suggest a positive treatment effect, although controls are lacking

Thus, it is not known if treatment alone is responsible for changes found. Within-group comparisons with adequate repeated baselines and another form of treatment before the one being studied makes possible a control procedure. Controlled Group Outcome Study in which an experimental (treatment) and control (placebo) group are observed (assessed). This is the strongest design especially if an attention-placebo control group is added.

Evaluating Biofeedback Effectiveness (A Proposed Clinical Research Design):

In clinical treatment, especially with the fee-paying client it is unethical to have a no-treatment control condition. However, it is not impossible to do reasonably effective and ethical clinical research in practice. The following models, are presented as ethical and powerful methods to obtain understanding of clinical biofeedback outcomes. These models, while not exhaustive, are in order of increasing effectiveness in demonstrating the effect of biofeedback. They are kept as basic as possible so that they provide as little intrusion into the clinical situation as possible. The key concept is that of adequate baselines (psychological, physiological, evaluative, self-rating --specific and global), and comparison with effectiveness of standard treatment.

Group I:
- Baselines
  - Biofeedback
    - Standard Treatment
      - Biofeedback
        - Outcome

Group II:
- Baselines
  - Standard Treatment
    - Biofeedback
      - Standard Treatment
        - Outcome

Group III:
- Baselines
  - No-treatment control
    - Outcome

Baselines obtained for one month prior to first actual treatment session. (Effectively a waiting list condition with initial evaluation, assessment and psychophysiological measures)

Standard treatment consists of the traditional and usual treatment for the particular disorder. This could be medication, or other commonly used approaches which would be regarded as the best treatment available.

Group III is not possible in ethical clinical work, although it represents a potentially important experimental control. However, if determined by other than research considerations, a waiting list of several weeks or months might be regarded as a no-treatment control condition.

Conclusion:

Over the last several years of my research involvement in biofeedback, I have been sharply critical of the quality of clinical application and 'consumerism'mentality of those who have applied biofeedback in practice. It has been important to me that practitioners who use these methods be aware of the limitations and precautions of the field and endeavor to do more than just charge a fee for "services" not as yet proven. It is, however, equally true that if all clinicians were to wait until definite proof were obtained for any treatment, there might be few treatments available today. Some cautious and conscientious balance between experimentation and application must be achieved. The Biofeedback Research Society has recently renamed and altered itself in an attempt to deal with just these issues.

Too few attempts have been made by the clinician to check the efficacy of his work or do ongoing quality control. In past years at Biofeedback Society meetings, the papers presented in this vein too often sounded like "I did this Alpha training thing and it seemed to work on this one guy!"

That procedures are novel and experimental should not prevent their reasoned clinical utilization. However, there is a need for systematic, well thought out application, understanding of limitations and precautions before launching out on an unproven course with a needy patient. To attempt to relate criteria, contra-indications, outcome and follow-up is an important move in the right direction.

APPENDIX

Appendix I: Sample Forms
- Information form
- First visit form
- Session record
- Last visit form
- Follow-up
- Research Card/ Symptom progress graph
- Patient visit record / training record

Appendix II: Tests
- MMPI Questions
- MMPI Profile / Scoresheet
- Schedule of Recent and Anticipated Experiences
- Locus of Control Modification

Appendix III: Biofeedback Information
- Biofeedback Society Information
- Major Biofeedback Instrument Manufacturers.
- Sample training program

APPENDIX IV: Summary of Evaluation of Clinical Biofeedback: Preliminary Descriptive Data

APPENDIX V: Outline for Brain Biofeedback Research

APPENDIX VI: BIBLIOGRAPHIES
- Selected Biofeedback Bibliography
- References

About the Author

Feedback Form

APPENDIX I

BIOFEEDBACK INSTITUTE OF SAN FRANCISCO 252
3428 Sacramento Street
San Francisco, California 94118
(415) 921-5455

Acct # _____
Ther. _____
MMPI _____
H-R p/f ___/___
I-E _____
for office use

INFORMATION FORM: PLEASE FILL OUT COMPLETELY

Name: _____ Date: _____

Home address _____ City: _____ Zip: _____

Business address _____ City: _____ Zip: _____

Home phone: _____ Business phone: _____

Date of birth: _____ Age: _____ Sex: _____ Marital status: _____

Education: _____ Occupation: _____

Household members: _____

Person to contact: _____ Phone: _____

List in order of importance the problem(s) for which you are seeking treatment. Please circle the number of times per week you experience the problem(s).

Problems	Number of times per week										Severity
1. _____	1 or less	2	3	4	5	6	7	10	15	25	50+	☐
2. _____	1 or less	2	3	4	5	6	7	10	15	25	50+	☐
3. _____	1 or less	2	3	4	5	6	7	10	15	25	50+	☐

Please rate the severity of the problem(s) according to the scale below:
(Put the number in the box to the right)

1= mild - the problem is just noticeable
2= moderate - the problem is annoying
3= severe - the problem interferes with daily life
4= extreme - the problem is often debilitating

How long have you had the problem(s)? 1) _____ 2) _____ 3) _____

List the doctors you have consulted for the problem(s) and give approximate dates.

1. Name: _____ City: _____ Dates: _____

2. Name: _____ City: _____ Dates: _____

3. Name: _____ City: _____ Dates: _____

List the kinds of treatment received for this problem.(e.g. psychotherapy, surgery, acupuncture, hypnosis, etc.):

How did you learn about the Biofeedback Institute?

MD___(_____)Other Professional___(_____)Friend___(_____)

TV/Radio___ Phone book___ Conference___ Class___ Other___(_____)

CHECK LIST: check those items which apply to you. Check only those items that you experience at least once or twice per week.

____Headaches	____Overeating
____Constipation	____Excessive urination
____Loose bowel movements	____Cold hands or feet
____Faintness or dizziness	____Blushing
____Hot flushes	____Twitches, tics, spasms
____Voice quavering or shaking	____Lump in throat
____Dry mouth	____Stuttering
____Tightness in jaw	____Grinding of teeth
____Soreness of muscles	____Lower back pains
____Weakness in parts of your body	____Heavy feelings in arms or legs
____Pains in heart or chest	____Heart racing
____Smoking	____Allergies
____Itching	____Tightness in stomach
____Sweaty palms	____Nausea or upset stomach
____Feeling tense or nervous	____Trouble getting your breath
____Shakiness	____Extreme fear of places or events
____Bad dreams	____Feeling fearful
____Your mind going blank	____Feeling inferior to others
____Difficulty making decisions	____Difficulty concentrating
____Trouble remembering things	____Thoughts of ending your life
____Thoughts hard to get rid of	____Worrying or stewing about things
____Difficulty staying asleep	____Loss of interest in things
____Poor appetite	____Difficulty in falling asleep
____Easily annoyed or irritated	____Uncontrollable outbursts of temper
____Easily crying	____Fatigue
____Loss of sexual functioning	____Loss of sexual interest or desire

List all medications you are currently taking for the problem(s) listed on other side:

Name of drug	Dosage (amount x times per day) (e.g. 5mg. x 3 per day)	Usefulness

List other medications you have taken for the problem(s):

List medications (current and past) taken for other conditions. Specify conditions.

On the line below, please indicate your general feeling of well-being at this time. Just make a mark on the line at the point at which you feel you presently are. 0 indicates the worst general feeling, 10 the best you could possibly feel.

Worst
0 _____ 10 Best

First Visit Form

NAME_____ DATE_____ THERAPIST(S)___/

INSTRUMENTS: TRNG: MON: SPECIAL PLACM:

GOAL: INSTRUCTIONS:

	EEG asi	FREQ.	AMP.	%	OTHER INSTRUCTIONS/COMME
	TIME &/or TRAINING LIMITS	asi bft T bbi bfi C TEMP r l o	asi JJ C T EMG ww f t o avg.'low	JJ bfi T C asi GSR r l o	

HISTORY

1. Onset & development of symptom/conditions assoc. with occurrence:

2. General medical history (illnesses, operations, chronic conditions, e

3. Previous psychotherapy, TM, relaxation training, etc.

4. Childhood/family/adolescence/sexual/present family life/relationships.

5. Education/occupation/avocations(hobbies, exercise, evenings).

6. Nutritional (include chemical and alcohol intake, smoking, etc.).

7. Brief self description (include strengths and weaknesses).

CONTRACT: _____

DIAGNOSIS: _____

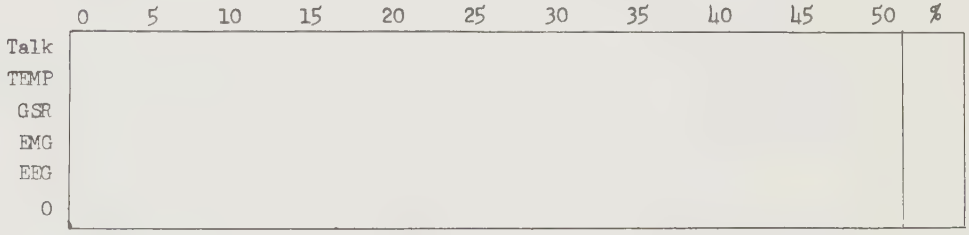
PRELIMINARY TREATMENT PLAN: _____

NAME_____ DATE_____ SESSION #____ THERAPIST(S)_____ /256

INSTRUMENTS: TRN:_____ MON:_____ SPECIAL PLACM._____

GOAL:_____ INSTRUCTIONS

EEG asi		FREQ.	AMP.	%	OTHER INSTR./ COMMENTS
MIN.	TRAINING LIMITS	asi bft T bbi bfi c TEMP R L O	asi JJ C T EMG W F T O Avg. Low	JJ bfi t c asi GSR R L O	
Base					
5					
10					
15					
20					
25					
30					
35					
40					
45					
50					



PLAN:

Home Practice (_____) ___Times this week

Please indicate the number of times you experienced your main problem this past week.

1 or less 2 3 4 5 6 7 10 15 25 50+

Please indicate the overall severity of your main problem during this past week.

1. ___ extreme - it was frequently debilitating
2. ___ severe - it interfered with my daily life
3. ___ moderate - it was definitely annoying
4. ___ mild - it was just noticeable
5. ___ none - as it did not occur, it was not at all severe.

On the line below, please indicate your general feeling of well-being at this time by making a mark on the line at the point at which you feel you presently are. 0 indicates the worst general feeling, while 10 is the best you could possibly feel.

WORST BEST
0 _____ 10

NAME_____ DATE_____

LAST VISIT INFORMATION

We are interested in knowing how you have changed since your first visit here. Your feedback will assist us in our continuing efforts to develop successful treatment programs.

Please provide the following information and return the form to the secretary. We appreciate the time and thought you give to this. All information is confidential.

1. THE MAIN PROBLEM FOR WHICH YOU RECEIVED TREATMENT (OR TRAINING) HERE AT BFI WAS:

   _____

2. PLEASE RATE YOUR IMPROVEMENT SINCE THE START OF TREATMENT:

   Maximum ___ Significant ___ Moderate ___ Slight ___ None ___

3. WHAT HELPED YOU THE MOST WAS: (Please give the "most helpful" a "1", the next "most helpful" a "2", etc.)

   ___ Biofeedback training
   ___ Relaxation training: Group ___ Individual ___
   ___ Talking with the therapist
   ___ Home practice
   ___ Other (Please specify): _____

4. IF YOU DID BIOFEEDBACK TRAINING, WHICH INSTRUMENT HELPED MOST?

   ___ EEG (Alpha) ___EMG (Muscle tension) ___ OTHER:
   ___ TEMPERATURE ___GSR (Skin response) _____

5. PLEASE LIST THE MEDICATIONS (AND AMOUNTS) YOU ARE PRESENTLY TAKING FOR THE PROBLEM TREATED HERE:

Name of drug	Dosage (amount x times per day) (e.g. 5 mg. x 3 per day)

6. HOW MANY TIMES PER WEEK DO YOU EXPERIENCE THE PROBLEM TREATED?

   a) at the present time

   1 or less 2 3 4 5 6 7 10 15 25 50+

   b) just before the start of treatment here

   1 or less 2 3 4 5 6 7 10 15 25 50+

7. PLEASE INDICATE WITH A CHECK MARK (✓) THE SEVERITY OF THE PROBLEM FOR WHICH YOU WERE TREATED HERE.

	severity at present	severity at beginning of treatment
EXTREME (often debilitating)	_____	_____
SEVERE (interferes with daily life)	_____	_____
MODERATE (annoying)	_____	_____
MILD (just noticeable)	_____	_____
NONE (not at all)	_____	_____

8. CHECK LIST: CHECK THOSE ITEMS THAT YOU EXPERIENCE AT LEAST ONCE OR TWICE PER WEEK.

___Headaches
___Constipation
___Loose bowel movements
___Faintness or dizziness
___Hot flushes
___Voice quavering or shaking
___Dry mouth
___Tightness in jaw
___Soreness of muscles
___Weakness in parts of body
___Pains in heart or chest
___Smoking
___Itching
___Sweaty palms
___Feeling tense or nervous
___Shakiness
___Bad dreams
___Your mind going blank
___Difficulty making decisions
___Trouble remembering things
___Thoughts hard to get rid of
___Difficulty staying asleep
___Poor appetite
___Easily annoyed or irritated
___Easily crying
___Loss of sexual functioning
___Overeating
___Excessive urination
___Cold hands and/or feet
___Blushing
___Twitches, tics, spasms
___Lump in throat
___Stuttering
___Grinding of teeth
___Lower back pains
___Heavy feeling in arms or legs
___Heart racing
___Allergies
___Tightness in stomach
___Nausea or upset stomach
___Trouble getting your breath
___Extreme fear of places or events
___Feeling fearful
___Feeling inferior to others
___Difficulty concentrating
___Thoughts of ending your life
___Worrying or stewing about things
___Loss of interest in things
___Difficulty in falling asleep
___Uncontrollable outbursts of temper
___Fatigue
___Loss of sexual interest or desire

9. INDICATE YOUR GENERAL FEELING OF WELL-BEING ON THE LINE BELOW. 0 indicates the worst feeling, 10 means the very best feeling.

WORST BEST
0 _____ 10

THE BIOFEEDBACK INSTITUTE OF SAN FRANCISCO
A Psychological Corporation

3428 Sacramento Street
San Francisco, California 94118
(415) 921-5455

We are interested in knowing how you have been since your last visit here. Your feedback will assist us in our continuing efforts to develop successful treatment programs.

Please provide the following information and return the form in the envelope provided. We appreciate the time and thought you give to this. Feel free to contact us directly at any time. All information is confidential and is coded by number only.

1. MY REASON (MAIN PROBLEM) FOR COMING TO BFI WAS: _____

2. AT THE END OF TREATMENT (OR TRAINING) MY IMPROVEMENT WAS:

   Maximum ___ Significant ___ Moderate ___ Slight ___ None ___

3. WHAT HELPED ME THE MOST WAS: (Please give the "most helpful" a "1", the next "most helpful" a "2", etc.)

   ___ Biofeedback training
   ___ Home practice
   ___ Relaxation training: Group ___ Individual ___
   ___ Talking with therapist
   ___ Other (Please specify): _____

4. IF YOU DID BIOFEEDBACK TRAINING, WHICH INSTRUMENT HELPED THE MOST? (Again please rank the most helpful as 1, the next as 2, etc.)

   ___ EEG (Alpha) ___ EMG (Muscle tension) ___ Other: _____
   ___ TEMPERATURE ___ GSR (Skin response) _____

5. SINCE MY LAST VISIT TO BFI, MY CONDITION HAS:

   ___ Worsened ___ Remained the same ___ Improved

6. MEDICATION FOR PROBLEM: (Choose one) ___ None taken then or now

   ___ Decreased ___ Same ___ Increased ___ Changed type: _____

7. HOW MANY TIMES PER WEEK DO YOU EXPERIENCE THE PROBLEM FOR WHICH YOU CAME TO BFI? (Circle the best estimate from numbers below)

   a. At present

      1 or less 2 3 4 5 6 7 10 15 25 50+

   b. At the end of treatment at BFI

      1 or less 2 3 4 5 6 7 10 15 25 50+

   c. At the beginning of treatment at BFI

      1 or less 2 3 4 5 6 7 10 15 25 50+

8. PLEASE INDICATE WITH A CHECK MARK (✓) THE SEVERITY OF THE PROBLEM FOR WHICH YOU CAME TO BFI.

	severity at present	severity at end of treatment	severity at beginning of treatment
EXTREME (often debilitating)			
SEVERE (interferes with daily life)			
MODERATE (annoying)			
MILD (just noticeable)			
NONE (not at all)			

9. ON THE LINE BELOW PLEASE INDICATE YOUR "GENERAL FEELING OF WELL-BEING" AT THIS TIME. (Just make a mark on the line at the point at which you feel you presently are: 0 indicates the worst you could possibly feel, 10 is the best possible general feeling.)

WORST 0 _____ BEST 10

10. PLEASE FEEL FREE TO ADD ANY COMMENTS YOU THINK ARE PERTINENT. (You may wish to comment on different ways in which your life has changed since treatment ended, or on the treatment itself, the therapist, other staff, the facilities, or how the treatment compares with other therapies you have received.)

Thank you for returning this form right away so that we can improve our clinical services.

George D. Fuller, Ph.D.
Clinical Director

Therapist	Patient	#	Sex	Age	Intake Mo/yr	Last Visit	Total hrs.	Medic'n (over) Yes No	Referral · MD · Other Prof'l · Friend · Self

Chief Complaint

Diagnosis
Specific, plus coding category if different. (See back for code).
Main:
Other:

Treatment
Rate success control'g modality
% time Rate 1-5

Talk ___ ___ Hypnosis___
EEG ___ ___ Relax'n
EMG ___ ___ group___(Xs)
GSR ___ ___ Relax'n
Temp ___ ___ tapes ___
Other___ ___Video ___
Monitor(what)___
Home visit___

Homework
Yes No
Kind:
Regularity:
1__2__3__
Poor Good

Outcome

	Main	Other
0(3 visits)	___	___
1(None)	___	___
2(Slight)	___	___
3(Moderate)	___	___
4(Signif)	___	___
5(Maximum)	___	___

Follow-Up
Date | Rate 0-5
Length___
Comment:

OVER

UNISORT ANALYSIS CARD FORM Y8 Burroughs Business Forms PRINTED IN U.S. AMERICA

Medication: If yes, what?___
Use at start___ End___

Comments on major factors influencing treatment outcome:

Patient's subjective report:

Frequency and duration of symptom occurrence:

	Times wk	Times mo	Severity (0-10)
1st visit:			
Last wk/mo:			
History:			

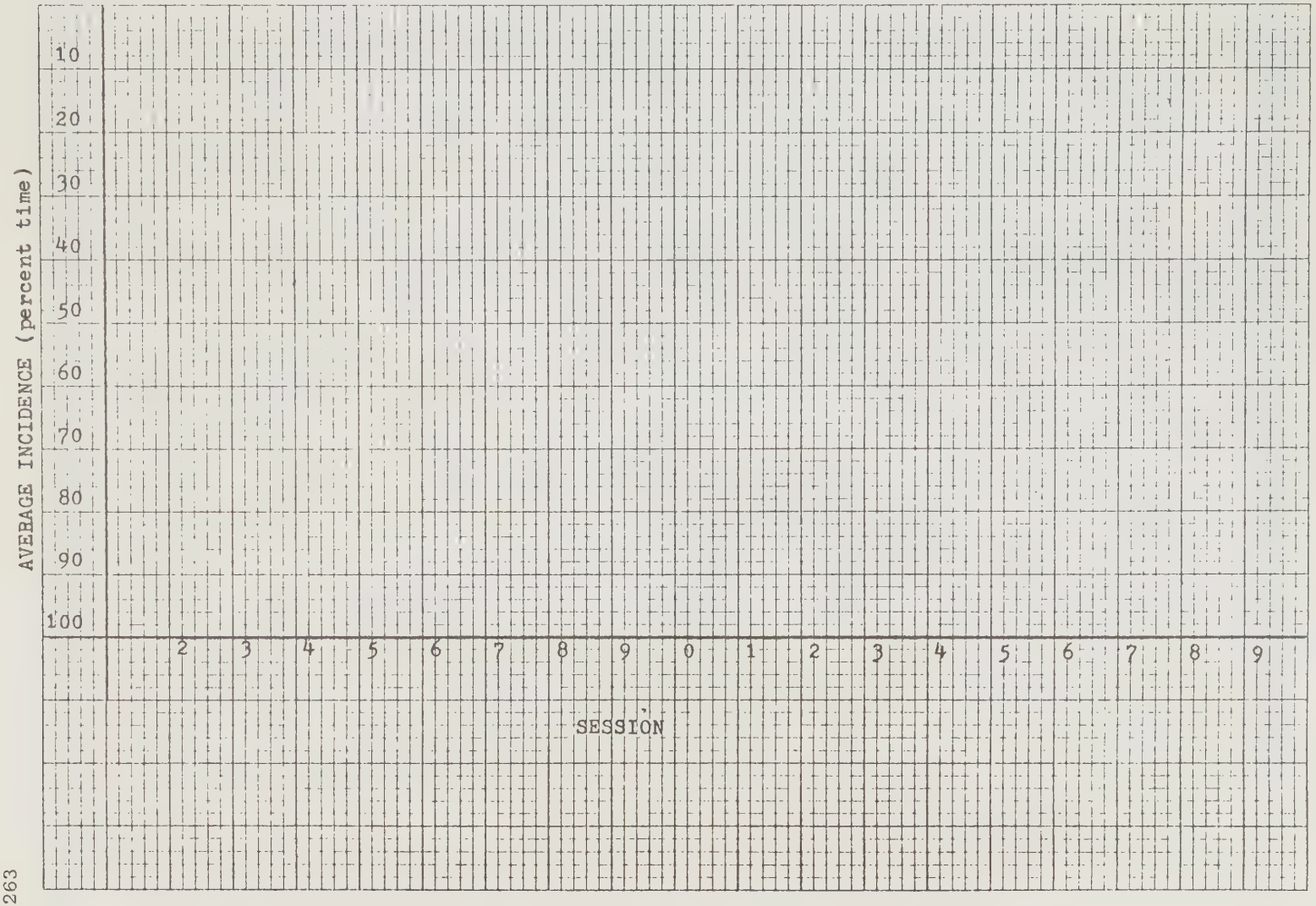
MMPI T scores Profile

	Pre	Post		Pre	Post		Pre	Post
L	___	___	2	___	___	7	___	___
F	___	___	3	___	___	8	___	___
K	___	___	4	___	___	9	___	___
1	___	___	6	___	___		Pre:	Post:

Coding Categories

34 Anxiety
35 Phob
36 Obse ssive-Comp.
37 Depression
38 Psychosis
39 Smoking
40 Alcoholism/Drugs
41 Insomnia
42 Stuttering, voice prob.s
43 Tics, spasms
44 Tension headaches
45 Migraine
46 Hypertension
47 Circulation
48 Cardiovascular
49 Gastro-intestinal
50 Asthma
51 Pain
5 Muscle tension
53 Muscle re-educ'n
54 Concentration, Atten'n, Memory
55 Reading, subvocalization
56 Personal growth, explor.
57 Other

NAME:


AVERAGE INCIDENCE (percent time)
10
20
30
40
50
60
70
80
90
100
2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9
SESSION

The Biofeedback Institute of San Francisco, Inc.

SESSION RECORD

Fee_____

Name_____ Diagnosis_____ Insur. Co._____

Date	Session/ Therapist	Procedures Training(T) Monitor (M)	% Time Spent	Success Rate 1-5	Homework N/A, 0(none) 2,3(compl)	Symptom Freq.(F)/ Severity(S) 0-10	Pertinent Comments
/ /	1/						
/ /	2/						
/ /	3/						
/ /	4/						
/ /	5/						
/ /	6/						
/ /	7/						
/ /	8/						
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/ /	25/						

HOME RECORD **Next Appt._____Please bring this card.

Name_____Symptom_____

Dates:	SUN ( )	MON ( )	TUES ( )	WED ( )	THURS ( )	FRI ( )	SAT ( )
Relaxation Trng (times)							
Symptom start end peak Duration Intensity (0-10 worst)							
Medication							

SLEEP RECORD

Day of week							
Time to bed to sleep							
Est. time to fall asleep							
Time asleep							
Time awaken							
Sleep time							

Comments:
(i.e., medication, feelings, drunk, dreams, etc.)

THE BIOFEEDBACK INSTITUTE OF SAN FRANCISCO TRAINING RECORD

DATE	EEG		GSR		EMG		TEMP		

PATIENT VISIT RECORD: TO BE COMPLETED BY THE THERAPIST AT EACH VISIT

PATIENT'S NAME _____

FOR BFI USE	SESSION NO.	DATE	SERVICE (P.T., Biof. Trng. etc)	FEE	RECEIVED	THERAPIST
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					

APPENDIX II

NAME_____AGE_____SEX_____DATE_____

PLEASE CHECK THE FOLLOWING ITEMS, MARKED TRUE OR FALSE, AS THEY APPLY TO YOU MOST OF THE TIME. PLEASE ANSWER ALL THE QUESTIONS.

TRUE	FALSE		
()	()	1.	I have a good appetite.
()	()	2.	I wake up fresh and rested most mornings.
()	()	3.	My daily life is full of things that keep me interested.
()	()	4.	I work under a great deal of tension.
()	()	5.	Once in a while, I think of things too bad to talk about.
()	()	6.	I am very seldom troubled by constipation.
()	()	7.	At times I have very much wanted to leave home.
()	()	8.	At time I have fits of laughing and crying that I cannot control.
()	()	9.	I am troubled by attacks of nausea and vomiting.
()	()	10.	No one seems to understand me.
()	()	11.	At times I feel like swearing.
()	()	12.	I have nightmares every few nights
()	()	13.	I find it hard to keep my mind on a task on a job.
()	()	14.	I have had very peculiar and strange experiences.
()	()	15.	If people had not had it in for me, I would have been much more successful.
()	()	16.	During one period when I was a youngster, I engaged in petty thievery.
()	()	17.	I have had periods of days, weeks, or months when I couldn't take care of things because I couldn't "get going".
()	()	18.	My sleep is fitful and disturbed.
()	()	19.	When I am with people I am bothered by hearing very queer things.
()	()	20.	I am liked by most people who know me.
()	()	21.	I have often had to take orders from someone who did not know as much as I did.
()	()	22.	I wish I could be as happy as others seem to be.
()	()	23.	I think a great many people exaggerate their misfortune to gain the sympathy and help of others.
()	()	24.	I get angry sometimes.
()	()	25.	I am certainly lacking in self-confidence.
()	()	26.	I have little or no trouble with my muscles twitching or jumping.
()	()	27.	Much of the time I feel as if I ahve done something wrong or evil.
()	()	28.	I am happy most of the time.
()	()	29.	Some people are so bossy that I feel like doing the opposite of what they request, even though I know they are right.
()	()	30.	I believe I am being plotted against.
()	()	31.	Most people will use somewhat unfair means to gain profit or an advantage rather than to lose it.
()	()	32.	I have a great deal of stomach trouble.
()	()	33.	Often I can't understand why I have been so cross and grouchy.
()	()	34.	At times my thoughts have raced ahead faster than I could speak them
()	()	35.	I believe that my home life is as pleasant as that of most people I know.

NAME_____AGE_____SEX_____DATE_____

TRUE	FALSE		
()	()	36.	I certainly feel useless at times.
()	()	37.	During the last few years I have been well most of the time.
()	()	38.	I have periods in which I carried on activities without knowing later what I had been doing.
()	()	39.	I feel that I have often been punished without cause.
()	()	40.	I have never felt better in my life than I do now.
()	()	41.	What others thing of me does not bother me.
()	()	42.	My memory seems to be all right.
()	()	43.	I find it hard to talk when I meet new people.
()	()	44.	I feel weak all over much of the time.
()	()	45.	I have very few headaches.
()	()	46.	I have had no difficulty in keeping my balance in walking.
()	()	47.	I do not like everyone I know.
()	()	48.	There are people who are trying to steal my thoughts and ideas.
()	()	49.	I wish I were not so shy.
()	()	50.	I believe my sins are unpardonable.
()	()	51.	I frequently find myself worrying about something.
()	()	52.	My parents have often objectd to the kind of people I went around with.
()	()	53.	I gossip a little at times.
()	()	54.	At times I feel that I can make up my mind with great ease.
()	()	55.	I hardly ever notice my heart pounding and I am seldom short of breath.
()	()	56.	I get mad easily and then get over it soon.
()	()	57.	I have periods of such great restlessness that I cannot sit long in a chair.
()	()	58.	My parents and family find more fault with me than they should.
()	()	59.	No one much cares what happens to me.
()	()	60.	I do not blame aperson for taking advantage of someone who lays himself open to it.
()	()	61.	At times I am all full of energy.
()	()	62.	My eyesight is as good as it have been for years.
()	()	63.	I do not often notice my ears ringing or buzzing.
()	()	64.	At one or more times in my life I felt that someone was making me do things by hypnotizing me.
()	()	65.	I have had periods in which I feel unusually cheerful.
()	()	66.	Even when I am with people I feel lonely much of the time.
()	()	67.	I think nearly everyone would tell a lie to keep out of trouble.
()	()	68.	I am more sensitive than most other people.
()	()	69.	At periods my mind seems to work more slowly than usual.
()	()	70.	People often disappoint me.
()	()	71.	I have used alcohol excessively.

The Minnesota Multiphasic Personality Inventory

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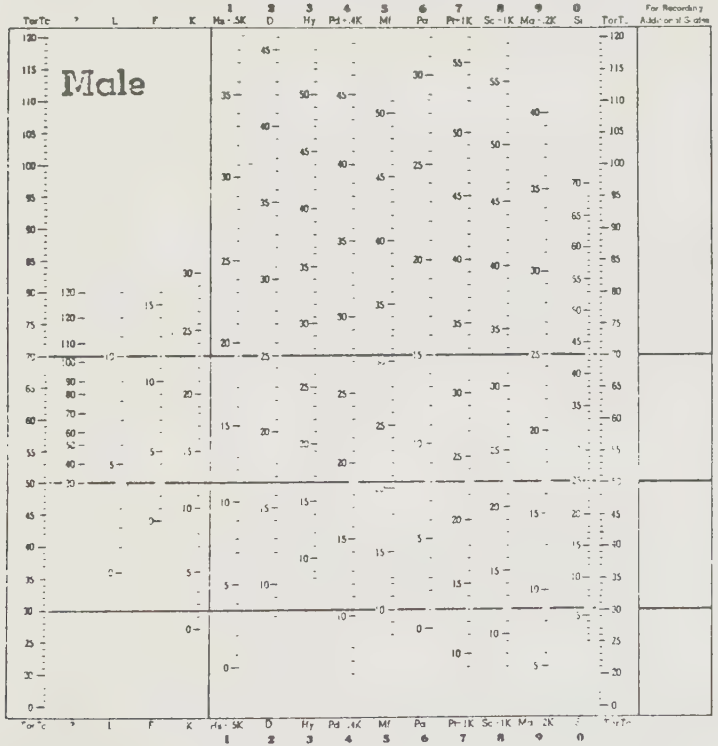
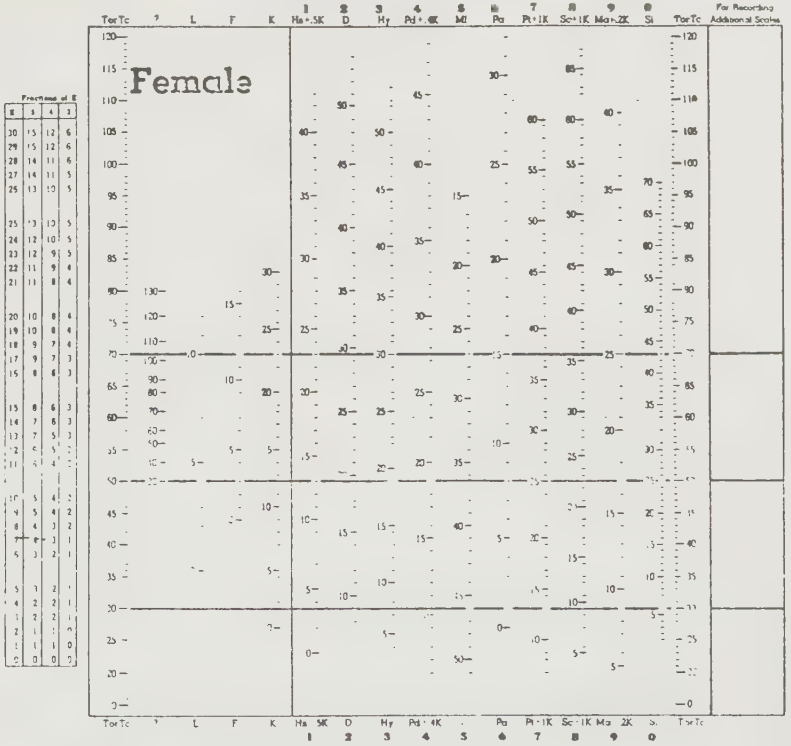
NOTE IF ANSWER SHEET ON THE REVERSE IS TO BE MACHINE SCORED, DO NOT MAKE ANY MARKS ON THIS SIDE UNTIL AFTER IT HAS BEEN SCORED. NOTE

Name _____ Age _____ Sex _____ Date Tested 1. 2.





	?	L	F	K	1 Hs+.5K	2 D	3 Hy	4 Pd+.4K	5 Mf	6 Pa	7 Pt+1K	8 Sc+1K	9 Ma+.2K	0 Si
Raw Score														
K to be added														
Raw Score with K														

	?	L	F	K	1 Hs+.5K	2 D	3 Hy	4 Pd+.4K	5 Mf	6 Pa	7 Pt+1K	8 Sc+1K	9 Ma+.2K	0 Si
Raw Score														
K to be added														
Raw Score with K														

	1	2	3	4	5	6	7	8	9	0
Raw Score										
K to be added										
Raw Score with K										

	1	2	3	4	5	6	7	8	9	0
Raw Score										
K to be added										
Raw Score with K										

Signature _____ Scorer's Initials _____

First MMPI:

See MMPI-A

NAME _____ AGE _____ SEX _____ DATE _____

ITEM	SCORED	L	F	K	1	2	3	4	6	7	8	9
1	T				F	F	F					
2	T				F		F			F		
3	T					F	F	F		F	F	
4	F					T						T
5	-	F							T	T	T	
6	T				F	F						
7	F							T			T	T
8	-								T	T	T	T
9	F		T			T	T					
10	F							T	T		T	
11	T	F		F		F	F					
12	F		T									
13	F					T	T	T		T	T	
14	F							T			T	
15	F		T					T	T		T	
16	F							T			T	
17	F					T				T	T	
18	F				T	T	T					
19	F		T									
20	T		F									
21	F										T	
22	F					T		T		T		
23	T			F			F					
24	T	F	F									
25	F					T				T		
26	T				F		F				F	
27	F							T		T		
28	T					F	F	F	F			
29	-						F		F			T
30	F		T						T		T	
31	T			F			F		F			
32	F				T							
33	T			F			F					
34	-			F				F				T
35	T						F	F				

ITEM	SCORED	L	F	K	1	2	3	4	6	7	8	9
36	-			F		T				T		
37	T				F	F	F					
38	F		T								T	T
39	F								T		T	T
40	T			F		F	F					
41	T			F			F	F				
42	T					F				F	F	
43	T			F			F	F				F
44	F				T	T	T			T		
45	T				F		F					
46	T				F		F				F	
47	T	F										
48	F		T									
49	T						F	F				
50	F		T									
51	-			F						T		
52	F							T				
53	T	F										
54	F											T
55	T				F		F					
56	T			F			F					
57	F						T			T	T	T
58	F		T					T				
59	F		T									
60	-					F						T
61	T		F	F		F						
62	T				F		F					
63	T				F				F		F	
64	F		T						T		T	
65	T			F		F		F				
66	F								T	T	T	
67	T			F					F			
68	F								T	T		
69	T			F								
70	T			F								
71	F		T					T				

	L	F	K	1	2	3	4	6	7	8	9
TOTALS RAW SCORE FOR MINI-MULT:											
ESTIMATE STANDARD MMPI RAW SCORE:											

SCHEDULE OF RECENT AND ANTICIPATED EXPERIENCES

This form is to help us understand what types of stress and changes you are experiencing. These items have an indirect influence on your health status and will aid in our evaluation.

NAME:_____ _____

AGE:_____

DATE:_____

If any of these life events have happened to you in the last 12 months, put a check in the box in the Column headed "Past".

If you anticipate that the event will happen to you in the next 12 months, put a check in the box in the Column headed "Future".

	PAST	FUTURE	
1.	☐	100 ☐	- Death of spouse
2.	☐	73 ☐	- Divorce
3.	☐	65 ☐	- Marital separation
4.	☐	63 ☐	- Jail term
5.	☐	63 ☐	- Death of close family member (except spouse)
6.	☐	53 ☐	- Major personal injury or illness
7.	☐	50 ☐	- Marriage
8.	☐	47 ☐	- Fired at work
9.	☐	45 ☐	- Marital reconciliation
10.	☐	45 ☐	- Retirement
11.	☐	44 ☐	- Change in health of family member (not self)
12.	☐	40 ☐	- Pregnancy
13.	☐	39 ☐	- Sex difficulties
14.	☐	39 ☐	- Gain of new family member
15.	☐	39 ☐	- Business readjustment
16.	☐	38 ☐	- Change in financial state
17.	☐	37 ☐	- Death of close friend
18.	☐	36 ☐	- Change to different occupation
19.	☐	35 ☐	- Change in number of arguments with spouse
20.	☐	31 ☐	- Mortgage over $10,000
21.	☐	30 ☐	- Foreclosure of mortgage or loan
22.	☐	29 ☐	- Change in responsibilities at work
23.	☐	29 ☐	- Son or daughter leaving home
24.	☐	29 ☐	- Trouble with in-laws
25.	☐	28 ☐	- Outstanding personal achievement
26.	☐	26 ☐	- Spouse begin or stop work
27.	☐	26 ☐	- Begin or end school
28.	☐	25 ☐	- Change in living conditions
29.	☐	24 ☐	- Change in personal habits (self or family)
30.	☐	23 ☐	- Trouble with boss
31.	☐	20 ☐	- Change in work hours or conditions
32.	☐	20 ☐	- Change in residence
33.	☐	20 ☐	- Change in schools
34.	☐	19 ☐	- Change in recreation
35.	☐	19 ☐	- Change in church activities
36.	☐	18 ☐	- Change in social activities
37.	☐	17 ☐	- Mortgage or loan less then $10,000
38.	☐	16 ☐	- Change in sleeping habits
39.	☐	15 ☐	- Change in number of family get-togethers
40.	☐	15 ☐	- Change in eating habits
41.	☐	13 ☐	- Vacation
42.	☐	12 ☐	- Christmas
43.	☐	11 ☐	- Minor violations of the law

NAME _____ DATE _____

Directions: In each pair of statements, choose the one which most closely describes your beliefs, and circle the letter A or B. If you agree with both statements, or disagree with both statements, choose the one you agree with more. There are no right or wrong answers.

1. A. Many of the unhappy things in people's lives are partly due to bad luck.
   B. People's misfortunes result from the mistakes they make.

2. A. In the long run people get the respect they deserve in this world.
   B. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

3. A. Without the right breaks one cannot be an effective leader.
   B. Capable people who fail to become leaders have not taken advantage of their opportunities.

4. A. No matter how hard you try some people just don't like you.
   B. People who can't get others to like them don't understand how to get along with others.

5. A. I have often found that what is going to happen will happen.
   B. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

6. A. When I make plans, I am almost certain that I can make them work.
   B. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.

7. A. In my case getting what I want has little or nothing to do with luck.
   B. Many times we might just as well decide what to do by flipping a coin.

8. A. It is hard to know whether or not a person really likes you.
   B. How many friends you have depends upon how nice a person you are.

9. A. In the long run the bad things that happen to us are balanced by the good ones.
   B. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

10. A. Many times I feel that I have little influence over the things that happen to me.
    B. It is impossible for me to believe that chance or luck plays an important role in my life.

11. A. People are lonely because they don't try to be friendly.
    B. There's not much use in trying too hard to please people; if they like you, they like you.

12. A. What happens to me is my own doing.
    B. Sometimes I feel that I don't have enough control over the direction my life is taking.

APPENDIX III

BIOFEEDBACK SOCIETY INFORMATION

Biofeedback Society of America

President: Charles F. Strobel, Ph.D., M.D.(1977)
Elmer Green, Ph.D. (1978)
Erik Peper, Ph.D. (1976)

Ms Francine Butler, Executive Director
Psychiatry C268
University of Colorado Medical Center
4200 East Ninth Avenue
Denver, Colorado 80262
(303) 394-7054

Biofeedback Society of California

President: Melvyn R. Werbach, M.D.(1977)
Erik Peper, Ph.D.(1978)
George D. Fuller, Ph.D.(1976)

Ms Leslie Tauber, Executive Director
2043 B Pine Street
San Francisco, California 94115
(415) 931-6049

Major Biofeedback Instrument Manufacturers

Aquarius Electronics
P.O. Box 96
Albion, Calif. 95410
(707) 937-0064
(Biofeedback instrumentation and custom instrument design)

Autogenic Systems Inc.
809 Allston Way
Berkeley, Calif. 94710
(415) 548-6056
(Biofeedback instrumentation and data acquisition systems)

Biofeedback Electronics
P.O. Box 1491
Monterey, Calif. 93940
(408) 373-2486
(Temp/GSR/Penile erection feedback)

Biofeedback Instruments Inc.
213 West Plain Street
Wayland, Mass. 01778
738-4502
(GSR devices)

Bio-Feedback Research Institute, Inc.
6325 Wilshire Blvd.
Los Angeles, Calif. 90048
213 933-9451
(Biofeedback instrumentation)

Bio-Feedback Systems Inc.
(Karlan Industries)
881 Dover Drive, #20
Newport Beach, Calif. 92663
(303) 444-1411
(Biofeedback instrumentation)

Narco Bio-Systems
7651 Airport Blvd.
PO Box 12511
Houston, Texas 77017
(713) 644-7521
(Physiographs and biofeedback instrumentation)

Neuronics
104 East Oak
Chicago, Ill. 60611
(312) 649-1400
(biofeedback instrumentation, single unit multi-mode)

Para Medical Instrument Co.
2350 Lafayette Ave.
Bronx- New York 10473
- - -
(Electronic blood pressure cuff)

Self Control Systems
PO Box 6462
San Diego, CA 92106
- - -
(Standard and portable EMG Biofeedback)

Somatronics, Inc.
399 Beuna Vista East #323
San Francisco, CA 94117
(415) 626-3120
(Pocket Size EMG monitor)

Systec, Inc.
500 Locust St.
Lawrence, Kansas
(913) 843-8844
(Biofeedback Instrumentation)

Bio-Feedback Tech. Inc.
10612A Trask Avenue
Garden Grove, Calif. 92643
(714) 537-3800
(Biofeedback instrumentation)

Cyborg Corporation
342 Western Avenue
Boston, Mass. 02135
(617) 782-9820
(Muscle re-education systems and biological feedback instrumentation)

Electro Labs
P.O. Box 2386
Pomona, Calif. 91766
(714) 624-0393
(EMG for neuromuscular re-education and nerve stimulation)

Extended Digital Concepts
P.O. Box 9161
Berkeley, Calif. 94709
(Kit-form small EMG/EEG)

G & W Applied Science Laboratories
(Gulf & Western Res. and Dev. Group formerly Whittacher)
335 Bear Hill Road
Waltham, Mass. 02154
(617) 890-5100
(Cardio-tachometer pulse rate monitor, BP devices)

J & J Enterprises
22797 Holgar Court, N.E.
Poulsbo, Wa. 98370
(206) 779-3853
(Low cost compact biofeedback instrumentation)

Other Relevant Manufacturers:

Biobehavioral Instruments
1663 Denver Ave.
Claremont, CA
(714) 593-3668
(Wrist temperature trainer)

BioMonitoring Applications, Inc.
270 Madison Ave.
New York, N.Y.
(202) 258-2724
(relaxation and biofeedback lecture tapes)

John Chaney Instrument Co.
965 Wells St (PO Box 72)
Lake Geneva, Wisc. 53147
(414) 248-4449
(Miniature thermometers at low cost)

Linear Instruments
17282 Eastment Ave.
Irvine, CA 92714
(714) 546-6776
(Reasonably Priced Multi-Channel Recorders)

Remco Tape Products
5547 Vineland
North Hollywood, CA 91601
- - -
(Adhesive electrode collars)

Thought Technology, Ltd.
2193 Clifton Ave.
Montreal, Quebec,Canada
(514) 484-0305
(Small hand-held GSR device)

THE BIOFEEDBACK INSTITUTE OF SAN FRANCISCO

A Psychological Corporation

3428 Sacramento Street
San Francisco, California 94118
(415) 921-5455

PLEASE NOTE OUT-OF-STATE PROGRAM ON PAGE 6

PROFESSIONAL TRAINING PROGRAMS

1976-77

***APPLICATION**
a clinic for the use of biofeedback techniques with specific psychophysiological disorders

***TRAINING**
for continuing education and conferences for professionals

***CONSULTATION**
Program development for agencies, businesses and organizations

***RESEARCH**
a center for information and research in clinical applications of biofeedback

George D. Fuller, Ph.D.
Clinical Director

James H. Anderson, Ph.D.
Alan Brauer, M.D.
Forrest Decker, M.S.W.
DeLee Lantz, Ph.D.
Fredrick Lasker, M.D.
Larry Meredith, Ph.D.
Robert Mithun, M.D.
Suzanne Sampson, R.P.T.
Pennie Sempell
Leslie Tauber

Edwin May, Ph.D.
Electronics Engineer

Consultants

Vera Fryling, M.D.
Joseph Kamiya, Ph.D.
Robert J. Riopelle, M.D.
Eric Peper, Ph.D.
Steven Locke, M.D.

A training program designed to meet the certification requirements of the Biofeedback Society of California is being offered by the Biofeedback Institute of San Francisco, a BSC approved training facility. This 80 hour program will be conducted on 5 consecutive weekends, and will include:

20 hours	Didactic Instruction
10 hours	Case Studies
20 hours	Personal Training with Instruments
	--10 hours supervised by certified trainer
	--10 hours supervised by peer
20 hours	Clinical Experience
10 hours	Supervision
	--5 hours individual supervision
	--5 hours group supervision
80 hours	Total *

Participants may register for all or only a portion of the total hours in any given training program.

Program Dates

I	II	III	IV
1976	1977	1977	1977
Oct. 29-30-31	Jan. 28-29-30	April 29-30-May 1	July 29-30-31
Nov. 6-7	Feb. 5-6	May 7-8	Aug. 6-7
" 13-14	" 12-13	" 14-15	" 13-14
" 20-21	" 19-20	" 21-22	" 20-21
" 27-28	" 26-27	" 28-29	" 27-28

SAMPLE ONLY

To apply, write to the Coordinator of Training Programs at the above address, please:
- --indicate which program you wish to attend, with alternate dates if possible
- --indicate which portion(s) you wish to include.
- --submit a Resume, including previous training and experience with biofeedback.

* 5 additional hours of Personal Training, to complete BSC requirements, will be arranged outside Training Program hrs.

Upon completion of the training program, participants will receive a certificate of completion which specifies the hours of training in each category. This may then be submitted to the Certification Committee of the Biofeedback Society of California .

PROGRAM DESCRIPTION

Didactic Instruction

Basic information on biofeedback, including theory, use of instruments, research, clinical applications and procedures, record keeping, relaxation techniques, videotapes. EMG, Temperature, EEG, GSR, and other instruments will be covered. Taught by BFI staff.

20 hours

Case Studies

Focuses on syndromes and clinical cases. Procedures, problems, contraindications, placebo effects, homework, ethics, and videotaped examples will be included. Taught by BFI staff.

10 hours

Personal Training

Personal biofeedback experience with instruments. 10 supervised training sessions with a certified BFI trainer (one-to-one), and 10 sessions directed by peer participant. Individuals with their own instruments and facilities may substitute 10 hours of work alone for the latter 10 hours and waive this fee. Biofeedback Society of California requires training with at least four different instruments.

With trainer 10 hours

Additional hours* 10 hours

Clinical Experience

Experience working with others in a clinical training setting. 10 hours with clients provided by the BFI, and 10 hours with a peer participant in the training program. Fee for the former 10 hours may be waived by individuals seeing their own clients at their own facilities, and discussing these sessions with their BFI supervisor.

20 hours

Supervision

Supervision of clinical experience and other matters of concern and interest to program participant. 5 hours of individual supervision with a BFI staff therapist, and 5 hours of group supervision by George Fuller, Director of BFI. Participants may receive additional hours of individual supervision upon request, at the same fee.

Individual 5 hours

Group 5 hours

TOTAL PROGRAM.....80 hours

*5 additional hours of Personal Training, to complete BSC requirements, will be arranged outside Training Program hours.

TRAINING FACULTY

George D. Fuller, PhD
Clinical Director, Biofeedback Institute of San Francisco. Staff Psychologist, Children's Hospital; Faculty, City College of San Francisco, UC Extension, San Francisco State University. Associate Clinical Professor, Dept. of Biological Dysfunction, UC Medical School, San Francisco. Past President. Biofeedback Society of California.

Frederick Lasker, MD
Private Practice in psychiatry and biofeedback. Attending Staff, Children's Hospital, and Mt. Zion Hospital in San Francisco.

Larry Meredith, PhD
Clinical Psychologist, Director, Alcoholism Evaluation and Treatment Center, San Francisco; Consultant to numerous hospitals and agencies.

James H. Anderson, PhD
Clinical Psychologist; researching biofeedback with stress related disorders; consultant to mental health and law enforcement agencies; Board of Directors, Biofeedback Society of California.

Alan Brauer, MD
Psychiatrist, Stanford University; researching stress management with heart attack and hypertensive patients. Coordin. Biof. Dept. Menlo Park VA Hospital.

Suzanne Sampson RPT
Physical Therapist, utilizes biofeedback to enhance physical therapy techniques. Consultant; Lamaze Instructor.

Forrest Decker, ACSW
Licensed Clinical Social Worker; Oakland VA Clinic. Family therapy practice.

Leslie Tauber
Biofeedback/relaxation trainer; conducts workshops and relaxation groups. Executive Director and Board of Directors, Biofeedback Society of California.

DeLee Lantz, PhD
Clinical Psychologist. Coordinator of Training Programs. Teaches psychology and biofeedback at various colleges and institutes. Research in cross-cultural cognitive development, biofeedback and physical disabilities.

Vera Fryling MD
Psychiatrist; Director, Autogenic Health Center, Oakland. Assistant Clinical Professor at UC medical school for 8 years. Lectures and leads workshops on Autogenic Training, Psychosynthesis and Biofeedback. President, Association for Humanistic Psychology, Bay Area chapter.

Robert Mithun, MD
Resident in Internal Medicine, Children's Hospital, San Francisco. Research on biofeedback and low back pain during pregnancy; pre-surgery biofeedback. Designs and builds electronic equipment; 1st Class FCC license.

Erik Peper, PhD
Past President, Biofeedback Society of America, President-elect, Biofeedback Society of California. Professor of Interdisciplinary Science, San Francisco State University. Co-director, Pain and Stress Clinic, Albany Hospital. Private practice in holistic health and biofeedback. Teaches autogenic training and biofeedback. Author of numerous articles on biofeedback.

Sample
Program Schedule

Week-end	Hours			
I	20	Fri. eve.	7:00 - 10:00	Didactic Instruction in Biofeedback
		Sat.	9:00 - 6:00	Didactic Instruction in Biofeedback
		Sun.	9:00 - 6:00	Didactic Instruction in Biofeedback
II	14	Sat.	9:00 - 1:00	Personal Training and Clinical Experience
			2:00 - 5:00	Case Studies
		Sun.	9:00 - 1:00	Personal Training and Clinical Experience
			2:00 - 5:00	Personal Training and Clinical Experience
III	14	Sat.	9:00 - 1:00	Personal Training and Clinical Experience
			2:00 - 5:00	Case Studies
		Sun.	9:00 - 1:00	Personal Training and Clinical Experience
			2:00 - 5:00	Personal Training and Clinical Experience
IV	13½	Sat.	9:00 - 1:00	Personal Training and Clinical Experience
			2:00 - 4:00	Case Studies
		Sun.	9:00 - 1:00	Personal Training and Clinical Experience
			1:30 - 4:00	Group Supervision/Lunch
			4:15 - 5:15	Personal Training and Clinical Experience
V	13½	Sat.	9:00 - 1:00	Personal Training and Clinical Experience
			2:00 - 4:00	Case Studies
			4:15 - 5:15	Personal Training and Clinical Experience
		Sun.	9:00 - 1:00	Personal Training and Clinical Experience
			2:00 - 4:30	Group Supervision

75 hours
+ 5 hours Individual Supervision, hours to be arranged with supervisor

80 hours Total

APPENDIX IV

Summary of Evaluation of Clinical Biofeedback
at Biofeedback Institute of San Francisco;
Preliminary Descriptive Data

The purpose of this section is to summarize and review the more pertinent results of ongoing research examining descriptive data. Summarizations of treatment effectiveness pend further evaluation of clinical data and follow-up. For a more complete picture of the results thus far obtained from this research one must refer to the accompanying complete tables and figures and graphs.

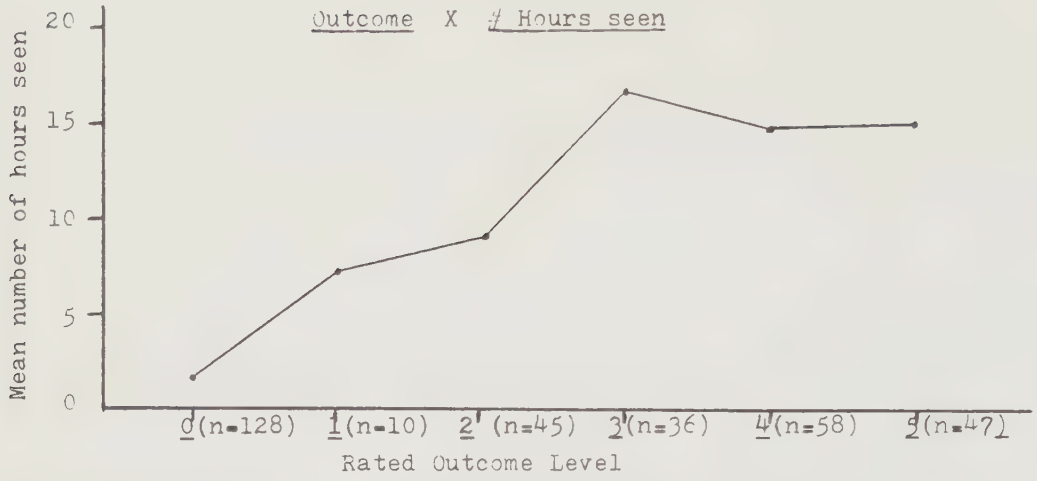
This commentary begins with a presentation of those variables relating to description of the clients included in this research and ends with a discussion of treatment and outcome variables.

Clients.

Included in this study were the first 324 clients seen and terminated at BFI. There were an equal number of males(164) and females (160) which is somewhat unusual when compared with most treatment clinics which ordinarily treat more women than men. The mean age of the client population was 37.6 with a standard deviation of 11.9. One-third of the sample (114/324) consisted of clients taking some form of medication for their condition, while the other two-thirds (210/324) were made up of those who did not take medications. There was a significant difference between the number of men on medication - 28% (46/164) - and the number of women who required medication to help control their condition - 42.5% (68/160) There was also found to be a significant difference in the mean age of those not on medication - 34.9 - and of those on medication - 42.4. Almost equal numbers of clients were referred by professionals - 99 by M.D.'s and 61 by other professionals - as were who were referred by friends or who found the BFI by themselves - 37 and 127 respectively.

FIGURES 1, 2 & 3

1.



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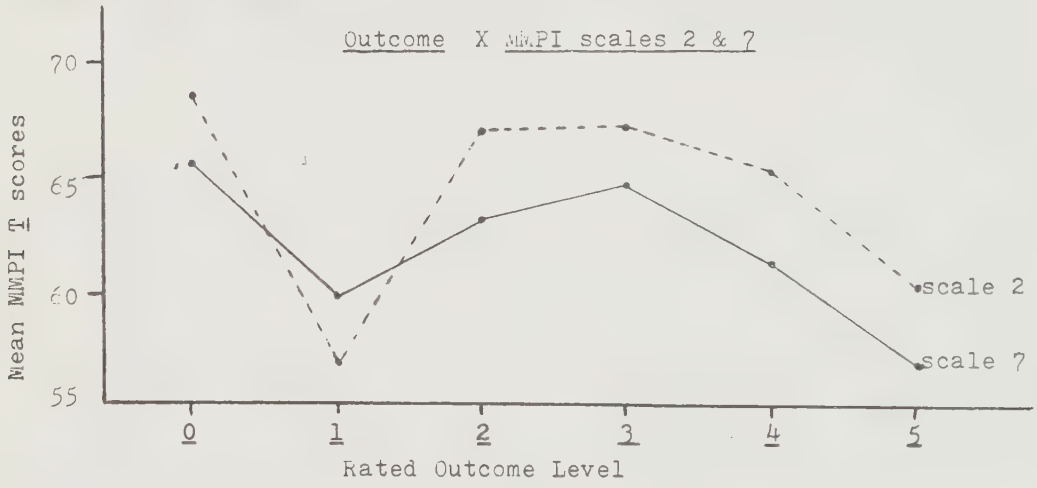
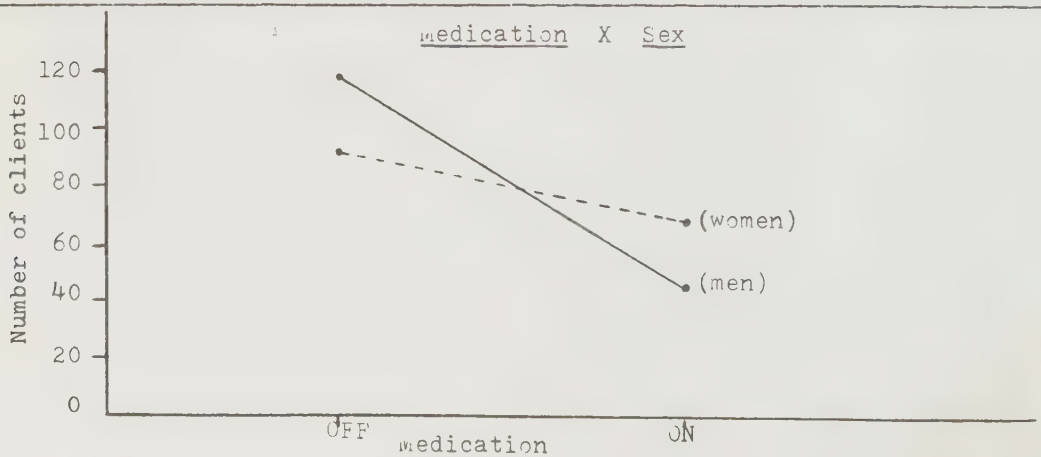


3.



Most of the clients in this sample fell into the following diagnostic categories:

Anxiety	54	16.7%	26 women	28 men
Depression	19	5.8%	5	14
Tension headaches	27	8.5%	14	13
Migraines	23	7.2%	15	8
Hypertension	12	3.7%	2	10
Pain	20	6.2%	15	5
Muscle tension	17	5.3%	8	9
Personal growth	31	9.6%	10	21

Other diagnoses included tics, phobias, insomnia, voice problems, etc. The numbers of medication users as opposed to non-users differed dramatically in certain diagnostic categories. For example, while 20 of the migraine clients used some sort of medication, only three did not; eighteen tension headache clients took medication while 9 did not; pain clients distributed themselves with 16 on and only four not on any medication; the ratios were reversed for muscle tension clients - 5 on and 12 not - and for clients whose primary diagnosis was that of anxiety - 13 on, 41 not on.

Pre-treatment MMPI scores were obtained from approximately 81% (264/324) of the present sample. It is worth noting that the mean validity scale T scores ranged between 50 and 55 with standard deviations ranging from 6.53 to 7.44, while the means of the clinical scales ranged from a low of 54.34 (scale 9) to a high of 66.44 (scale 4) with standard deviations between 7.81 on scale 9 and 14.15 on scale 2. Not unexpectedly a significant difference was found between users and non-users of medication on the clinical scales 1 (Hs) and 3 (Hy): on med clients' means were 64.29 and 67.93 (scales 1 and 3 respectively), while those not on meds obtained means of 58.64 and 65.17 respectively. A significant difference between these same two groups was also found on the K scale: 56.67 for med users and 53.27 for non-users.

Treatment and outcome.

In the present sample only one measure of outcome was available for all clients - an outcome rating made by the therapist at the end of treatment. The scale consisted of the following outcome ratings: 0 - used for those clients receiving treatment for three sessions or less and thus considered dropouts; 1 - indicates no improvement; 2 - slight improvement; 3 - moderate improvement; 4 - significant improvement; 5 - maximum improvement. The present sample of clients distributed itself this way: 0 - 128 or 39.5% of the sample; 1 - 10 or 3%; 2 - 45 or 13.9%; 3 - 36 or 11.1%; 4 - 58 or 17.9%; and 5 - 47 or 14.5%.

The major modalities of treatment were: talk or some form of psychotherapy which took up approximately 48% of the total treatment time for this sample and which was used in 84.3% (273/324) of the cases; EMG training (22.9% of the total treatment time) used in 52% (169/324) of the cases; TEMP (15% of the time) used in 39.5% (128/324) of the cases; EEG (12% of the time) in 22.5% or 73/324 cases; and GSR (8% of the time) in 26.5% or 86/324 cases.

The average length of treatment was 8.8 hours (SD = 11.9), but when dropouts were excluded, the mean treatment time was 13.4 hours. Of the 196 clients who stayed for treatment, 23.5% (46) completed treatment in 4-5 sessions; 39.8% (78) received treatment lasting between 6-10 sessions; 14.8% (29) came in for 11-15 sessions; 7.7% (15) had treatment lasting from 16 to 20 sessions; 4.6% (9) of the clients received treatment lasting between 21 and 25 sessions; and for 9.7% (19) of the clients, treatment extended over more than 25 sessions (actual range was between 35 and 85 hrs.).

Of the total sample, 20% (65) received no biofeedback treatment at all: these are considered psychotherapy clients

since the treatment given consisted of 100% talk. Of these 65 clients, 42 (65%) were considered dropouts (came in for three sessions or less). Thus the clients given only psychotherapy as treatment at the BFI who formed a treatment contract constituted approximately 11.7% (23) of the total treated group. With respect to length of treatment these 23 clients whose treatment consisted solely of talk or psychotherapy distributed themselves as follows: 4-5 hrs. - 4; 6-10 hrs. - 5; 11-15 hrs. - 2; 16-20 hrs. - 1; 21-25 hrs. - 3; more than 25 hrs. - 8. The only striking item is that nearly half (42.1%) of those clients whose treatment lasted more than 25 sessions received no biofeedback treatment.

Length of treatment (i.e. number of sessions) differed widely between cases at different outcome levels: dropouts (0 outcome), of course, had the least number of sessions - 1.8 hrs.; outcome 1 - 7.2 hrs.; outcome 2 - 9.1 hrs.; outcome 3 - 16.7 hrs.; outcome 4 - 14.6 hrs.; and outcome 5 - 14.9 hrs. While these differences are rather large, the only ones which are statistically significant are those between the untreated or dropout group (1.8 hrs.) and the upper three outcome level groups(3 - 16.7 hrs., 4 - 14.6 hrs., and 5 - 14.9 hrs.).

An analysis of treatment outcome by medication revealed no statistically significant differences. However, there tended to be proportionately more medication users at the lower outcome levels than one would expect and proportionately fewer of them at the upper levels. While medication users constituted 35% of the overall sample, 60% of those clients at outcome level 1 and 46.7% of those at level 2 were on medication, while at the upper levels which indicate moderate to maximum improvement clients on medication made up only 32.6% of the group (25% at level 3, 36.2% at level 4, and 30.6% at level 5).

No differences in age were found for clients with different outcomes.

DIAGNOSIS X MEAN MMPI SCALE T SCORES

DIAGNOSIS	#	L	F	K	1	2	3	4	6	7	8	9
34- Anxiety	(42)	49.1	56.2	53.9	62.9	70.6	68.7	68.8	65.7	68.4	66.4	55.5
35- Phobia	(8)	47.3	52.8	50.6	49.2	64.6	60.0	61.6	59.4	59.0	58.6	49.0
36- Obsess-Comp.	(1)	50	69	49	91	105	75	76	61	91	90	73
37- Depression	(18)	49.9	58.3	53.2	57.4	73.8	66.8	69.2	63.7	71.9	66.1	56.3
38- Psychosis	(6)	47.2	69.5	48.7	62.2	78.7	70.2	78.3	74.8	72.7	91.2	61.5
39- Smoking	(5)	47.0	53.0	50.8	53.8	55.0	64.8	62.8	66.6	58.2	66.2	57.6
40- Alcoholism	(0)	-	-	-	-	-	-	-	-	-	-	-
41- Insomnia	(6)	50.7	53.3	54.3	63.7	77.5	71.8	69.8	63.0	68.0	67.3	56.3
42- Stut./Voice	(3)	45.3	48.0	51.7	52.3	58.7	57.7	54.7	64.7	62.0	64.7	52.7
43- Tics/Spasma	(5)	53.6	57.4	54.8	64.8	60.4	67.6	66.0	54.4	53.8	64.2	51.2
44- Tension HA	(24)	49.5	50.9	56.5	61.8	60.4	67.2	63.1	58.5	58.0	56.8	54.2
45- Migraine	(19)	51.0	54.4	58.5	60.9	59.5	63.5	63.8	58.1	56.9	58.4	53.3
46- Hypertension	(10)	52.5	52.4	55.6	57.8	63.0	61.5	60.7	56.0	56.1	55.6	51.1
47- Circulation	(6)	48.5	52.8	57.2	53.2	56.7	60.5	60.5	65.7	52.5	59.5	44.7
48- Cardiovascular	(1)	42	64	53	85	94	89	84	91	96	110	60
49- Gastro-intest.	(4)	51.3	51.8	54.5	68.0	68.3	71.3	67.3	54.5	65.3	69.0	59.0
50- Asthma	(4)	48.0	51.8	52.3	58.3	61.8	63.5	61.3	55.0	54.3	60.8	62.8
51- Pain	(19)	52.3	53.5	57.9	69.8	67.3	71.4	66.3	60.8	61.4	63.9	52.3
52- Musc. tension	(15)	50.6	54.9	54.5	62.7	64.4	68.1	64.5	60.8	65.4	65.2	54.6
53- Musc. re-educ.	(7)	49.6	54.8	57.9	59.6	60.9	65.0	68.7	52.4	59.7	61.3	52.7
54- Conc., Att., M	(9)	51.1	53.2	49.7	56.4	68.4	64.0	64.9	59.5	67.0	72.1	56.9
55- Read./Subvoc.	(1)	50	48	55	58	68	69	57	56	58	51	43
56- Pers. gro/Exp.	(18)	50.8	52.2	56.2	53.4	63.6	63.3	68.5	59.3	63.4	66.3	52.7
57- Other	(24)	51.8	55.9	52.5	58.8	66.5	62.5	68.6	62.5	60.5	66.7	55.0
58- Sex. dysfunct.	(4)	48.3	50.0	55.5	61.3	72.0	70.0	65.3	66.5	73.5	66.0	53.8
59- Overweight -	(3)	47.7	60.7	50.7	61.7	62.7	65.7	76.7	63.7	59.3	68.0	52.0
60- Bruxism	(2)	46.0	50.0	51.0	60.0	55.0	63.5	61.5	56.5	45.5	61.0	55.0

With respect to MMPI scores, scale 2 (D) and scale 7 (Pt) yielded siginificant differences between clients at different outcome levels. However these differences are relatively meaningless or uninterpretable. For example, differences between mean scale 2 scores are quite large when comparing dropouts with clients at outcome level 1 and outcome 5 (no change and maximum change), while the differences between dropouts and those at outcomes 2, 3, and 4 are quite small. Likewise on scale 7, the largest differences in mean scores occur between dropouts and clients at outcome 5 and outcome 1 while the mean score of dropouts is quite similar to those of clients at the intermediate outcomes. Such a lack of linearity in the relationship between outcome and MMPI scores makes the differences observed rather uninterpretable.

In the case of one treatment modality, talk or psychotherapy, a significant difference was observed between different outcome levels with respect to treatment time percentage. Talk was used as a treatment modality 55.7% of the total treatment time in the cases of dropouts while only used 42.9% of the time in the cases of remainers. Most probably, this difference reflects the need for more talk, questioning, counseling, discussion in the early sessions as opposed to later sessions when clients may spend longer periods silently training without as much need for talking. Early sessions demand that time be spent defining the parameters of the disorder, discussing its antecedents and consequences, etc. while later sessions demand much less of this.

No other significant differences were observed with respect to treatment time by treatment outcome.

In other two-way analyses examining treatment time by medication, it is noteworthy that the only two significant differences obtained revealed that clients on medication underwent EMG training for 28.9% of the total treatment time and TEMP training for 20.09% of the time while clients not on

medication used up only 18.4% and 11.09% of the treatment time on these modalities respectively. These differences are statistically significant and are further confirmed in the following observation: 64.9% of those clients on medication received at least some EMG training, but only 44.3% of all the non-medicated clients had some EMG training; and 45.6% of all clients on medication, as opposed to 34.3% of those not on medication, spent some time doing TEMP training as part of their treatment.

SUMMARY OF FINDINGS (N= 324)

Males = Females.

1/3 on Medication, more Women than Men, more Older.

1/2 referred by Professionals (most M.D.s) and Self (through friends).

Modal Diagnosis was Anxiety; Personal Growth, Tension Headaches, Migrain followed in frequency.

MMPI Average Profile: 9 (Ma) Low, 4 (Pd) High, 2 (D) had Greatest Standard Deviation.

Physical Therapist saw most of Pain cases, Muscle Reeducation.

Outcome: 1 No Improvement = 3%
2 Minimal Improv.=14%
3 Moderate Impr. =11%
4 Significant I. =18%
5 Maximum Impr. =15%

0 Not Treated
Dropped out
Referred out = 39%

Modality: Talk used in 84% of the cases
EMG used in 52% of the cases
TEMP used in 39% of the cases
EEG used in 22% of the cases
GSR used in 26% of the cases

Treatment Length: 8.8 Hours (sessions), Standard Deviation= 12.
13.4 Hours (sessions) if do not include dropout referred and not treated group.

Maximum successful outcome achieved by session 14.

No relationship between outcome and medication use or age.

APPENDIX V

OUTLINE FOR BRAIN BIOFEEDBACK RESEARCH

by
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Author's Note: This is a preliminary outline which has been left in original format; note, for example that EEG is "eeb" etc.

I. INTRODUCTION

Upon defining the characteristics of externally detectable brain waves and describing the subjective emotional states associated with the various electrical brainwave patterns the next step is the examination of various means of becoming aware of the particular state, recognizing the level of consciousness subjectively, and learning to control the state of mind in conjuction with control of brainwave activity. This portion of the study will deal with several aspects of learning as applied to eeb activity learning.

The first section concerns the psychological aspects of the psycho-physiological functions. Since the study of cortical electrical activity can hardly be isolated to separate studies of mind and body, the only separation to be made is in perspective. Therefore the first part of the following section is devoted to the philosophy of eeb research in light of conditioning.

The second section deals briefly with the instrumentation and training methods employed in eeb and physiological conditioning. These vary with each experimenter and therefore can be dealt with in only a general way, in outline form.

The third section deals with catagories of research and learning. Each division of psychological inquiry has investigated the electrical activity of the human brain and that of other animals and attempted to correlate hypotheses already in use with those of brainwave research.

II. THEORIES AND HYPOTHESES OF BIOFEEDBACK LEARNING

A. PSYCHOPHYSIOLOGICAL PRINCIPLE-

Every change in the physiological state is accompanied by an appropriate change in the mental-emotional state, conscious or unconscious, and conversly, every change in the mental-emotional state, conscious or unconscious, is accompanied by an appropriate change in the physiological state, (Green, etal 1970).

B. ROLE OF INSTRUMENTATION IN LEARNING CONTROL OF UNCONSCIOUS PROCESSES

1. Combined use of verbal report and physiological measures suggests the possibility that man may learn to exercise greater control over certain mental events, specifically those associated with controllable physiological events. (Stoyva, 1970) (Kamiya, 1968) (Hart, 1967)

2. Approach: Precise measurement of physiological and mental phenomena, information feedback, and shaping (Stimulus-response construct) are applicable to wide variety of psychophysiological events. (Stoyva, 1970)

C. GOALS OF FEEDBACK LEARNING PSYCHOPHYSIOLOGY

1. Internal control by the individual is the appropriate goal of applied psychology; teaching people to become self-directing and self controlled. (Hart, 1970)

2. Altered states of awareness - Identification and classification of states of awareness without assigning to these states any unusual causal properties. (Hilgard, 1969)

III. TYPES OF LEARNING OF PSYCHOPHYSIOLOGICAL CONTROL

A. AUTOGENIC-

1. Yoga - years of training in meditation enables certain individuals to control specific bodily functions and mind so that practitioner is obvious to external and internal stimuli. (Anand, etal, 1961)

2. Zen - similar to yoga in training time and observable phenomena. (Kasamatsu, Hirai, 1966)

3. Meditation & Self-Hypnosis - lengthy training (as compared with operant conditioning) produces altered self-awareness and limited control. (Bucke, 1961)

B. CLASSICAL CONDITIONING

1. Findings indicate class. conditioning is automatically and rapidly extinguished in humans (Jasper, Shagass, 1941)
2. Used primarily on animal cond. studies (Black, etal, 1970)

C. OPERANT OR INSTRUMENTAL CONDITIONING

1. Primary means of training in the control of autonomic nerve system and eeb patterns.
2. Training set up is closed loop (no outside stimuli) or open loop (E. can inject stimuli) electrical/mechanical path for information to flow from subject's body, through detection and recording devices to a feedback results indicator within the sensory field of the subject. Feedback may be sound (Kamiya, 1968), light (Brown, 1970), meter (Mulholland, 1968), or combinations of methods.
3. Training consists of either enhancement or suppression of eeb frequency bands, control of electrical activity, and manipulation of mental state and physiological state to achieve some beneficial result. (Mulholland, 1968; Kamiya 1962, 1968, 1970; Brown, 1969, 1970; Hart, 1967; Green etal. 1969, 1970)

D. TRAINING PROCEDURES (GENERAL)

1. Orientation testing--prior info is obtained in some experiments.
   a) personality inventory
   b) James I-E scale - behavior control
   c) Field dependence - (Rod & Frame)
   d) CPI-flecibility scale
   e) Recall test (Green, etal, 1969)

2. Baseline Testing - Alpha, Beta index for conditioning exp. (Peper, Mulholland, 1969, Peper 1970) Alpha, Theta index (London etal, 1969; Hart 1967; Green etal, 1969) for hypnagogic imagery, creativity.

3. Post Training Testing - questions on emotional states (feelings) - (Kamiya, 1970; Brown 1969-70; Antrobus etal, 1967)

IV. INSTRUMENTATION IN EEB FEEDBACK CONDITIONING

A. BASIC EQUIPMENT
1. Feedback learning equipment is basically similar, with peripheral plug-in devices and stimulating devices tailored to fit the particular experiment.
2. Equipment is sophisticated electronic receiver for electrical activity with frequency discrimination, multi-channel pick-up and recording capability, timed recording of voltage and frequency variations and conversion of signals to sensory stimuli.

B. TYPES OF EQUIPMENT - RESEARCHERS USE VARIOUS TYPES OF MONITORS
1. Grass Model 5 Eeb - basically a polygraph recording device with special inductive electrodes for brainwave detection (Mulholland Runnels, 1961, 1962; Dewan, 1964, 1967, Hart, 1967, Nowlis, 1968)
2. Grass Model 4 Polygraph (London etal, 1969)
3. Offner 8 Chan. Port. (Bagch, Wenger, 1957)
4. Grass Mod. 6 Eeb (Brown, 1969-70)
   a) This set up used as feedback stimulus a 6 volt blue light set in a box with a magnifier over the front(open) end with a 2 x 3 foot diffussion screen between the lamp and the subject. (Brown, 1970)
5. Peripheral Equip. - Grass 5E driver-amp. Krohn-hite adjustable band pass filter, Schmidt trigger, Audio Amp (Scott 299-B), Rectifier, state relays, time delay relays (Adjustable).

C. EQUIPMENT CONFIGURATION-
1. Electrodes attach to the subject's head with electrically conductive paste. The electrical signal is connected to an eeb amplifier. Output from this amp. is connected to the oscillograph for recording and oscilloscope for monitoring. Output is also fed through a low freq. filter & thru an audio amp. to a rectifier which drives a relay. The relay turns a function genrator on & off which in turn drives the audio or visual display. (Hartzell, Green etal, 1971) (Mulholland, 1962; Denan 1964, 67; Kamiya, 1962, 68)
2. In addition a computer is sometimes used for data monitoring, display, or correlation. (Brown, 1970)

V. CATAGORIES OF RESEARCH AND LEARNING

A. YOGA, ZEN, MEDITATION
1. Yogis, Zen practitioners exp. high degree of eeb control while in meditative state (Bagchi, Wenger, 1957)
2. Zen masters show exceptionally stable alpha with some theta but with wakening characteristics (Kasamatsu, Hirai, 1966)
3. Yogis & Zen masters maintain control even under stress from external sources and with eyes open (Bagchi, Wenger, 1958; Anand etal, 1961)

B. EEB AND CORRELATION WITH OCULAR STIMULATION AND ORIENTATION
1. Direct correlation between eye positioning and alpha inhibition (Dwan, 1967; Mulholland, 1969), therefore most alpha training is done with eyes closed.
2. Exp. show that eye shift and accommodation as well as visual "blurring" can increase alpha output. (Mulholland, Evans, 1965; Dewan, 1967). Other exp. showed that this was a low incident effect (Brown, 1969; Fenwick, 1966)
3. Ocular Function-Physiological and electrical as system, effects the production of alpha and alpha desynchronization. Alpha can be seen in terms of RAS effect, muscular tension, and attention to visual stimuli (Mulholland, 1968)
4. Internal, private, subjective, voluntarily directed attention states which are induced by prior instruction and activated by subject can be reliably inferred from eeb readlut (Mulholland Runners 1963)

C. OPERANT CONTROL, FEEDBACK REGULATION, AND AUTO-CONTROL OF EEB.
1. Subjects can learn in a few trials to discriminate between their own brainwave patterns if reinforced with verbal or audio stimulus (Kamiya, 1962)
2. Awareness of eeb and discrimination is more difficult to learn if there is no explannation of purpose or goal of experiment. (Rosenfeld etal, 1969)
3. Studies concern primarily with alpha enhancement and inhibition (theta-drowsiness inhibition, beta-alertness inhibition) because of its hypothetical relationship to a "pleasant" emotional state. Studies show that ocular functioning effects alpha but auditory function has little effect unless accompanied by ocular functioning, therefore feedback studies use audio feedback and assoc. mental activity as factors of feedback (Nowlis and Kamiya, 1970)
4. Feedback eeb can be used as index of behavior. (Peper, 1970)
5. Voluntary or auto control of eeb is a function of volition (psychological) and physo, parameters (resting state) (Green, etal, 1969) (Hart, 1968)

D. EEB AND ALTERED STATES OF CONSCIOUSNESS
1. Subjects can learn to descriminate between sleep states (Rem 1 & Stage 2 NREM) with verbal feedback. Sleep research is hampered by length of exp. and low motivation of Ss. (Antrobus & Antrobus, 1967)
2. Experiments on eeb alpha follow 3 stages-baseline testing, feedback learning, and Ss explanation of subjective emotional state. Most recent studies include a section in which subject tries to

describe his state while producing long alpha or theta trains.
3. New studies attempt to enhance Ss alpha in eyes open state, using light as stimulus, previously noted was finding that disattention or "blurring" of vision helped Ss to produce alpha, Exp. using low blue light behind diffusion device with emotional state questions after found that alpha was enhanced considerably and that a highly euphoric state was produced (Brown, 1969). Also noted that ocular displacement as a means to produce alpha was low incident phenomena.
4. After alpha training has been successfully completed it was noted that Ss "Resting" baseline alpha was higher than before training. Ss reactions were that they preferred to "produce" alpha rather than try to "suppress" alpha. (Kamiya, 1969)

E. CLASSICAL CONDITIONING OF EEB ACTIVITY
1. Early studies indicate classical cond. of eeb is possible but effects are automatically and quickly extinguished, (Jaspar, Shagass, 1941) (Jaspar, Cruikshank, 1938)
2. Classical cond. of animals both reward and punishment show good results for alpha and theta. Some exp. use curare as a means of obtaining good result definition (Carmona, 67, Sterman, Wykwicka 67, 68)

F. CORRELATION OF EEB AND CORTICAL EVOKED POTENTIAL AND INHIBITION.
1. Some studies have shown that alpha functions as a pacemaker for cortical activity by noting synchrony and asynchrony of bilaterally recorded alpha and beta activity (Garoutte, 1958)
2. Extreme anxiety impairs alpha activity (Wells, Wolf, 1960)
3. Studies are now underway attempting to link brain response, eeb with intelligence; attention and alerting time as faltors of intelligence (Shucard, 1970; Mulholland, 1969)

G. EEB, HYPNOSIS, AND SLEEP
1. Studies of eeb of Ss in both a hypnotic "trance" and while producing high degree of alpha show similar eeb patterns. There is a high degree of correlation between a parsons ability to produce alpha and hypnotic susceptability. (London, etal, 1968)
2. Studies show that hypnotic susceptability is enhanced by alpha training. Ss subjective evaluation of two states show a high degree of similarity (London, etal, 1970)

H. EEB AND ESP PERFORMANCE
1. Verbal reports indicate that theta is related to psychic experience. (No data in writing)

I. Introduction

A. General info about Brain waves
1. definition - fluctuations of electrical potential of the brain
2. measurement- EEG amplifies small voltage at scalp and traces out recordings
3. discovery - by Austrian psychiatrist Han Berger in 1929 (original articles and biography in Supp 38, EEG Clin. Neurophysiol.)

B. Wave characteristics
1. Each wave varies in characteristics other than freq. but there appears to be no systematic progression of change across the brain wave spectrum
2. In the freq band there seems to be specific dominant freq of synchronous waves at any one time.
3. Progression from one end of freq spectrum to other is thru intermediate freq. bands.
4. Measurable characteristics

	β	α	θ	δ
a. freq	12-50	8-12	3-8	1-3
b. amplitude	usually low	varies with 50 mood t as typical	usually low	high
c. shape	non synchronous varying	synchronous		synchronous

d. duration - amount of time in one state varies.

(1) α index (in %) = $\frac{\text{time in } \alpha}{\text{time monitored}}$

5. types
a. bursts - short duration (.5 sec) spindles (skytmic fluctuation of amplitude)
b. constant - longer duration occurring in spindles

6. Uniqueness
a. any given interval of acty. is unique
b. general characteristics of EEG record for one individual are similar at different time (Walsh, 1957)
(1) twins exhibit similar EEG characteristics
(2) limited identification by comparing EEG tracing-s of any one individual, can be made.

C. Brain wave states as an index of psychological and physiological state.
1. Identifiability of brain wave state is easily done; a quantifiable measure
2. Coorelations can be made to independent measured characteristics.
a. physiological punctioning
b. alertness-relaration state
c. intrapersonal state and personality characteristics
d. performance

II. Psychophysiological functioning

A. Neural functioning
1. Single neurone activity
   a. "all or none" principal
   b. electrical potential spike travels along neuron axon which causes chemical change which in turn causes neuron to fire
   c. excitability of single neurone
2. Brain waves are an aggregate of individual neuron activity - a gross measure of electrical acty. from them is what EEG provides
3. groups of neurons have propensity to exhibit rhuthmic electrical potential fluctuations (Adrian, 1947, Bremer, 1953)
   a. appears true of all brains cells - not just mano
   b. isolated brains have brain wave activity for hours after decapitation.
   c. this activity continues even when brain is subdivided.
   d. it continues when synaptic connections are blocked with nicotine (Libet and Gerard, 1939)
   e. freq of wave is coorelated to amt. of isolated cortical material.
4. Physiochemical factors affecting brain wave freq. (within limits of cell destruction.) (Libet & Gerard, 1939)
   a. positive coorelation of freq. to brain temperature
   b. PH coorelation beyond range of 7.8-6.2
   c. Osmotic pressure (sucrose level) seems to have little effect
   d. Presence of electralites
      1. Na^+ + K^+ INCREASES FREQ.
      2. Ca^{++} + Mg^{++} lower freq.
5. foci of brain wave activity
   a. α wave strongest in occipital region
   b. More than one region of α burst activity has been noted (brazier, 1949)
   c. As state progresses from α to Δ going to sleep, the focus of acty. shifts to the frontal region, with more than one focus commonly noted (Brazier, 1949)
6. Different cortical areas act as blocks of b.w. activity (Coopers Mundy - Castle, 1952)
   a. aregion of cortex may be in b.w. acty. at same freq but at different phas of wave
   b. different regions may have slightly different α freqs.
7. Brain wave sweeping
   a. α waves recorded along longitudinal axis of brain reach peak amplitude sequentially (sweep)
   b. usual movement of this apparent traveling front of activity is from front to rear.
   c. typical speed of front of peak α amplitude front is about 5 meters/second
   d. Instantaneous phase changes
      1. α wave measured from peak to peak of ten shows one short or long interval which causes phase shift.
8. Subcortical neural activity and brain waves
   a. Existance of some regulator of b.w. activity has been hypothesized (Bishop, 1949; Jasper, 1954)
   b. Activation of cortex by R.A.F. causes α blocking = β acty (Jasper, 1958; Lindsley, 1958; Moruzzi = Magoon, 1949)

II B waves & excitability cycles

1. cyclic waxing & waning of responsiveness of cortex to afferent volleys of sensory impulses, related to phase of wave has been shown (Bishop, 1933, Jarcho, 1949)
   a. phase coorelated to reaction times to visual stimuli (Lansing, 1957; Calloway & Yeazer, 1960)
   b. to accuracy of visual recognition of info shown at threshold levels.
2. This is consistant with theory of primary impulse discharge as origin of b.w. activity.
3. It appears that high excitability is associated with --phase of cycle (Dustman & Beck, 1965)
4. Following a synchronized vally in optic nerve, during recovery period, α like waves may develop. (Bartley 1936)
   a. this lasts up to 200 m sec
   b. appears as summations of high freq spontoneous discharge (Bishop & Clare, 1952)

II D Brain waves and sensory impulsed

1. Brain wave related excitability cycles would seem to cause delay in processing of afferent sensory information that is would appear as delayed reaction times in different b.w. states
2. Reaction times in β are slightly but significantly smaller
   a. when in α. (Boswell, it. al., 1962)
   b. Assuming constant transmission limis and cortical reactions time subsequent to arrival of sensory impulses this delay could be accounted for by excitability cycles.
3. Isolation of the brain causes stronger and more regular wave activity (Libet & Gerard, 1939)
4. Reaction to external stimuli
   a. de synchronition occurs when R.AF. currates cortex (Jasper, 1958)
   b. blocking time is related to α freq (Bernhard, Skoglurd, 1943)
   c. While reaction times can be altered by different presentation proceedures of stimuli, no cooresponding difference in blocking time was noted (Stamm, 1952)
5. Reaction upon eye closure
   a. α waves are commonly noted upon eye closure
   b. α starts at higher than normal freq & lower than normal amplitude, then changes to normal in 5-3 sec. (Cooper, Mundy-Costle, 1952)
   c. It is abouzht that eye closure allows the occupital area to begin synchronous activity which spreads across cortex.

II Attention & Brain wave state.

A. Some relations of bw state to attention to external stimuli and to involvement in specific mental operations appears to exist.

1. Coorelation is not one to one for some attentive states apparently enhance or have little effect upon a rhythms in (Mundy-Costle, 57)
2. There seems to be a general trend from alertness to relaxation associated with decrease of b.w. freg.
3. Individual difference of response to stimuli as were different individual responses are great. (Krutman & Shaw, 1965; Harrison, 1946)

B. β Wave state

1. is typical of alertness and active response (Ellingson, 1956)
2. Externally directed attention, especially that related to alerting stimuli generally is associated with β state and α blocking.
   a. Visual stimuli - this causes must effective α blocking
      (1) Photic stimuli - causes must consistant response in blocking time.
      (2) attention to visual field.
         (a) visual accomodation to objects seems to be a necessary part of α blocking (Dewan, 1966)
         (b) attemtped visual fixation, even with eyes closed or in darkened room is associated with α blocking (Adrian & Matthew,)
         (c) The more complex the visual stimulation the longer α supression is maintained (Berdyne, 1965); it is suggested that this is due in patterned fields to repealed bcular fixation & accomodation (Cobb,)
   b. Auditory stimulation - when not alerting type accasionaly induce α
      (1) barely audible stimuli, which seemingly require more attention for induce α more frequently (Durrup & Bessard, 1935) - in biofeedback situations had auditory feedback causes uncontialled α blocking
      (2) in intense auditory alertness β rhythms can be last α appear, but when accompanied by loss of ocular fixation & accomodation (Oswald, 1959)
   c. tactile stimulation
      (1) caused no change in increase in α activity in 70% cases tested (Traris & Berber, 1938)
   d. physical activity causes α blocking with duration of β period related to amt. of effort (Ivanova, 1959)
4. Internally directed attention
   a. problem solving (e.g. Math & Memory) generally causes an individual to move to β state (Kamiya, 1962; Harrison, 1946)
   b. Examples to the contrary sometimes occured (Larens & Darrow, 1962) in up to 30% of cases (Werre, 57)
   c. use of visual [illegible] mazry appears to cause blocking as a general trend with many exceptions (Krertman & Shaw, 1965)
3. Adaptation to environmental set
   a. there is an anparent increase of incipint α activity as one grows accustom to his surrounding (Gellharm, 1957)

C. α State
   1. is a reliable but not infalible index of relaxed wakefullness (Ellingson, 1956)
   2. there is a low coorelation - 47 between degree of attention estimated by subject and α index (fraissee & Vorllaume, 1961)
   3. Continuous attention sets (vice alerting stimulii) facilitates α wave production (Mulholland, 1962)
   4. Episodes of blank rut (loss of sense of vision) after periods of exposes to uniform field are associated with α activity
      (1) blinking supresses blank out and alpha production
      (2) indiv with high α under are most likely to experience blank out (Cohen, Cadwallader, 1958)
   5. Increased α amplitude and freq have been noted in conjunction with expectation of stimulii after a warming it was coming (Darrow, 1947, Williams 1940)

D. Low amplitude, lower freg α is indicative of a drowsy state (Anliker, 1963)
   1. usually subject lapses into first stage of sleep after this type of activity (Kamiya, 1961; foulkes & Voagel,)
   2. α tends to disappear as distinguishable wave just before going to sleep.

E. Θ state indicates individual is at the verge of sleep
   1. indiv can be easily brought to state of attention from this state (Kamiya, 1961)
   2. Individual returns to α with external stimulii (vice B) (Green, Green, 196-)
   3. When aroused subject in this state may assert he was not asleep.

F. Deep sleep indicates Δ activity
   1. after a period of apparently interspersed Θ & Δ, andividual goes into Δ
   2. Individual in this state is hard to awaken
   3. Usually individual in Δ state is not experiencing mental activity (Rechshaffen, et al., 1962, 1963; Kaleo, et al., 1965)
   4. EEG resperse to external stimuli can be noted in Δ (Allison, 1965; Hernandez-Pean, 1963, Rosner, et al., 1963, Williams et al. 1962, 1964; Wabiman & Kremen, 1965)

IV Physiological coorelates to B.W. states
   A. Autonomic nervous system functioning
      1. Heart rate
      2. Blood pressure
      3. Relative temperature
      4. Palmer conductance
         a coorelated to α activity (Malmo, 1959)
      5. Autonomic balance
         b. there appears to be no relationship between α index and predominance of one domain (Sternbeck, 1970)
      6. Glandular activity
   B. Voluntary movements
      1. There are some indication that relationship exists between initiation of voluntary randon muscle movement & α phase (Kibbler & Richter, 1950)
         a. In repetitive muscle activity no relationship was seen (Cooper; Mundy-Costle, 1960)

IV C. Wave freq and age
1. very slow and large α waves in fetus (Asimov, 1963)
2. α freq increases during childhood until about age 17, with freq in the 8-12 Hz range (Burger, 1932; Davis & Davis, 1936; Bernhard & Skaglund, 1939; Lindsley, 1936; Durup & fessard, 1936; Loomis et al., 1936; Smith, 1937)
3. from age 17 on α rate decreases (friedlander, 1958)
4. No information on other Brain wave states is available

V. Performance
A. Problem solving
1. a coorelation of - 46 was found between α index and problem solving efficiency (Bechman, Stein, 1961)
B. Memory
1. Immediate digit recall was better in α state as opposed to won α (β) after feedback training (Hefferman, 1970)
C. Perception
1. time perception is poor when subject is in low amplitude α state (Drowsy) (Anliker, 1963)
D. Intelligence testing
1. there is some indication that Intelligence test performance is lower for individuals with higher α index. (Sugarman, 1961)
E. Reaction times
1. are reliably but only slightly shorter in β than in α state (Boswell, et al., 1962)

VI feelings, moods & personality traits
A. Internal subjective states-certain moods of feelings are associated with periods of different brain wave states
1. α -pleasurable feeling, increased inner awareness (indirected subjective responses)
uncertainty, contemplative, transcendental thinking, remembering, drowsy, passive, sleepy, wish fulfillment, intense, tired slugish (forced choice selections of descriptors)
2. β unpleasant thoughts, excitment (undirected descriptions) angry, aggravated, initated impatient, unhapppy, shakely, investigative. (forced choice selections)
3. θ problem sovling, orunting self to environment (undirected) vacillating, passive, sleepy, wish fulfillment (Brown, 1970)
4. δ - deep sleep
B. Moods associated with α state are increasingly noted in individuals after α feedback training (Schmerdler & Lewis, 1971)
C. Emotional stimulii or feelings when correlated to brain wave states produce ambiguous results
1. word association of emotional words had no effect upon α activity (Harrison, 1946)
2. but another experiment during visual perception of emotional signifcant and neutral words showed less activity during emotional sig words (Herneman & Emrich, 1970, Dixon & Lear, 1963)
3. supression has been related to states of worry, fear or apprehension.

VI B. Personality facts

1. coorelation of personality profiles with α index
   a. higher α index-passive, submissive, dependent receptive, avoids effort, responsiblity & contact with others
      (Saul, Davis & Davis, 1949; McAdam & McClatchey, 1952)
      Slow, cautions, steady (Mundy-Castle, 1953)
   b. low α index
      consistent, well directed, having a freely indulged drive to activity (Saul et al., 1949, McAdam, AmClatchey, 1952)
      quick, empulsive, variable, highly stimulable, (Mundy-Castle, 1953)
   c. a basic dichotony of passive - active personaltiy coorelated to high to alpha under has been suggested (McAdam & Dime, 1954)
2. Neurotic tendances and brain wave states
   a. Ranked Rorschach replies determining neurotic tendancies show a coorelation of-411 with α index (McAdam & Orme, 1954)
   b. There are indications that sweeping direction of brain waves in related to neurotic behavior with Anterior to posterior as normal (Cooper - Muncy-Castle, 1960)
3. There seems to be no coorelation between MMPI test scores and α wave characterustucs (α index - amplitude
   (Costa, Cox, & Katrman, 1965)

APPENDIX VI

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Born in Györ, Hungary as Zoltan György Desiderius von Bozzay, he fled with his mother into Austria during World War II, before coming to the United States at the age of six. Travelling throughout the country as part of an Air Force family, George attended thirteen schools in twelve years, graduating from Kubasaki American Dependents High School in Okinawa.

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Active in biofeedback, George has been the president of the Biofeedback Society of California (1976); Co-Chairman of the Biofeedback Society of America annual training workshops; Insurance Committee Chairman of the Applied Division, and Co-Chairman of State Societies of BSA.

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